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ENGINEERING RAIL IMPACT AND TIEDOWN TEST OF THE XM1063 ASL 102 INCH WIDE SEMITRAILER

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U.S. Army Tank-Automotive Command
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EVALUATION DIVISION
SAVANNA, ILLINOIS 61074-9639

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The U.S. Army Defense Ammunition Center and School (USADACS), Evaluation Division (ATTN: SMCAC-DEV), was asked by the U.S. Army Tank-Automotive Command (TACOM), Warren, MI, to rail impact test the XM1063 ASL 102 Inch Wide Semitrailer. In addition to rail impact testing, the ten tiedown and six slinging provisions were tested to the loading requirements of MIL-STD-209G, Military Standard, Slinging and Tiedown Provisions for Lifting and Tying Down Military Equipment. The railcar tiedown procedure was supplied by TACOM.

Rail impacts occurred at 4, 6, 8 and 8 reverse miles per hour. The semitrailer moved an overall distance of three inches on the stanchion. No damage occurred to the tiedown fittings, one half inch tiedown cables

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☐ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION
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#19 Abstract

or flatcar pockets used in securing the tiedown cables. The tiedown procedure required the use of axle stands. After the reverse impact one axle stand experienced damage to the side brace and slipped such that the edge of the 4 x 4 vertical support rested on the axle centerline.

One problem was encountered when tying down the semitrailer to the railcar. The tiedown provisions located between the wheels did not have sufficient spacing to allow a minimum of one inch clearance between the tiedown cable and semitrailer. This problem was attributed to the depth of the trailer tiedown provisions from the outside edge of the trailer and the width of the railcar. The common flatcar used had a width of 9 feet 6 inches. If the width had been 10 feet 6 inches, the tiedown cables probably would have achieved the one inch clearance. The smaller flatcar is more readily available and is the recommended size for rail shipments of military equipment. The XM1063 ASL 102 Inch Wide Semitrailer has six slinging provisions. Five of the slinging points were loaded vertically upward to 24,000 pounds. The load was applied for a period of not less than 90 seconds. All tested provisions remained intact. Minor damage occurred at a weld between a channel steel member and the slinging provision series. One slinging provision was not tested because it was incorrectly mounted on the trailer and not accessible for pulling. Diagonal loads were not applied due to lack of equipment capable of applying a 32,000 pound load.

Tiedown provision pull tests consisted of applying a forward and aft tension of 16,000 pounds and a downward pull of 8,000 pounds. Each load was applied for a minimum of 9 seconds. Two vertical downward pulls were not done because of interference between the tiedown provision and rear wheels did not allow enough space for the dynamometer.

The XM1063 ASL 102 Inch Wide Semitrailer passed the rail impact test and the pull tests of the tiedown and slinging provisions. An exception was taken to the style of tiedown and slinging provisions in that they do not follow the guidelines of MIL-STD-209G.

U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL

Evaluation Division

Savanna, IL 61074-9639

REPORT NO. 5-89

ENGINEERING RAIL IMPACT AND TIEDOWN TESTS OF THE

XM1C63 ASL 102 INCH WIDE SEMITRAILER

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PART 1

GENERAL

A. INTRODUCTION. The U.S. Army Defense Ammunition Center and School (USADACS), Evaluation Division, was requested by the U.S. Army Tank Automotive Command (TACOM) to test the XM1063 ASL 102 Inch Wide Semitrailer to the requirements of the American Association of Railroads (AAR) for rail shipment and to test the slinging and tiedown provisions to Military Standard Slinging and Tiedown Provisions for Lifting and Tying Down Military Equipment (MIL-STD-209G). The tiedown procedure used to secure the semitrailer to the flatcar was supplied by TACOM.

B. AUTHORITY. This test was conducted in accordance with mission responsibilities delegated by the U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, IL. Reference is made to Change 4, 4 October 1974, to AR-740-1, 23 April 1971, Storage and Supply Operations; AMCCOM-R 10-17, 13 January 1986, Mission and Major Functions of USADACS.

C. OBJECTIVE. The objective of these tests was to determine if the XM1063 ASL 102 Inch Wide Semitrailer would satisfy the AAR rail transportation requirements and MIL-STD-209G provision pull tests.

D. CONCLUSIONS. The XM1063 ASL 102 Inch Wide Semitrailer satisfied the AAR and MIL-STD-209G test requirements. An exception was taken to the style and placement of slinging and tiedown provisions in that they do not conform to the guidelines of MIL-STD-209G. The tiedown provisions, positioned above the rear wheels, need to be changed to allow more clearance between the tiedown cable and the rear wheels. The present location (recessed under the

semitrailer) and the 102 inch trailer width causes the cables to contact the rear tires. Buffers were added to reduce the scuffing, but it was not effective in preventing damage to the tires (scuffing). It should be pointed out that the rail impact test does not simulate a long rail transportation period, but a short one. In a long haul situation, the tires could be cut by the tiedown cables.

Minor hairline weld cracking was observed in the top lifting provisions. This cracking could be prevented if; a) a full weld was used around the channel steel used to maintain separation between the top lift provision side arms or, b) the thickness of the side arms could be increased.

E. RECOMMENDATIONS. It is recommended that the tiedown provisions be repositioned on the XM1063 ASL 102 Inch Wide Semitrailer to eliminate interference between the road equipment and tiedown cables. It is also recommended that the top lift provision be strengthened to prevent weld cracking.

PART 2

ATTENDEES

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Mark R. Fischer (813) 748-3900 Ex. 228	Miller Trailers, Inc. 3709 67th. St. W Bradenton, FL

PART 3

TEST PROCEDURES

1. RAIL IMPACT TEST. The test load or vehicle should be positioned in/on a railcar. For containers, the loaded container shall be positioned on a container chassis and securely locked in place using the twist locks at each corner. The container chassis shall be secured to a railcar. Equipment needed to perform the test includes the specimen (hammer) car, five empty railcars connected together to serve as the anvil, and a railroad locomotive. These anvil cars are positioned on a level section of track with air and hand brakes set and with the draft gear compressed. The locomotive unit pulls the specimen car several hundred yards away from the anvil cars and, then, pushes the specimen car toward the anvil at a predetermined speed, disconnects from the specimen car about 50 yards away from the anvil cars allowing the specimen car to roll freely along the track until it strikes the anvil. This constitutes an impact. Impacting is accomplished at speeds of 4, 6, and 8 mph in one direction and at a speed of 8 mph in the opposite direction. The 4 and 6 mph impact speeds are approximate; the 8 mph speed is a minimum. Impact speeds are to be determined by using an electronic counter to measure the time required for the specimen car to traverse an 11 foot distance immediately prior to contact with the anvil cars.

2. SECURING PROVISION TESTS. The securing provision tests were extracted from MIL-STD-209G as follows:

A. TIEDOWN PROVISIONS. The tiedown provision tests are based on paragraphs 5.1.2 (Class 2 Tiedown Provisions) and 5.5.3 (Tiedown Provisions). Class 2 provisions shall withstand; 4.0 times the Maximum Shipping Weight

(MSW) in the forward and aft direction of the longitudinal axis of the equipment, 2.0 times the the MSW in the downward direction of the vertical axis, and 1.5 times the MSW in each direction of the lateral axis. The force applied to each provision shall be its proportionate share of the MSW. Each load shall shall be maintained for a period of not less than 9 seconds. A suitable measuring device (dynamometer or load cell) shall be placed between the provision and the applied force.

B. SLINGING PROVISIONS. The basis for the slinging tests are paragraphs 5.1.1.2 (For Equipment with the MSW of 25,000 pounds or more) and 5.2.2 (Slinging Provisions). The maximum shipping weight (MSW) of the XM1095 ASL Van is 40,000 pounds. A design load of 2.3 times the working load of each provision is required. The test load is applied to the lifting provision for a period of 90 seconds. A suitable measuring device (dynamometer or load cell) shall be placed between the provision and the applied force.

PART 4

TEST RESULTS

A. [illegible] IMPACT TEST

TEST SPECIMEN: XM1063 ASL Van Semitrailer

TEST FLATCAR NO: SP&S 34085 LT. WT.: 47,100 pounds

LADING & DUNNAGE WT.: 39,000 pounds

TOTAL SPECIMEN WT.: 86,100 pounds

BUFFER CAR (5 CARS) WT.: 221,000 pounds

IMPACT NO.	END STRUCK	VELOCITY	REMARKS
1	Forward	4.05 mph	Load shifted toward impact end 1 inch.
2	Forward	5.10 mph	Load shifted toward impact end 1-1/2 inches.
3	Forward	8.22 mph	1. Load shifted toward impact end 1-1/2 inches. 2. Load shift measured on stanchion.
4	Reverse	8.06 mph	Load shifted three inches at stanchion.

PART 4

TEST RESULTS

B. STATIC PULL TESTS

1. Tiedown Provisions

MSW = 40,000 pounds

Number of Provisions = 10

Provision Load Share = 4,000 pounds

DIRECTION	TEST FACTOR	APPLIED LOAD
Longitudinal	4.0	16,000 pounds
Vertical Down	2.0	8,000 pounds
Lateral	1.5	6,000 pounds

Longitudinal and lateral loads were applied to all provisions. Vertical loads were not applied to the provisions above the rear trailer wheels. All loads remained applied for six seconds or longer. No damage on any provision was observed.

2. Slinging Provisions

MSW = 40,000 pounds

Number of Provisions = 4

Provision Load Share = 10,000 pounds

DIRECTION	TEST FACTOR	APPLIED LOAD
Vertical	2.3	23,000 pounds

The XM1063 ASL 102 Inch Wide Semitrailer has six slinging provisions. In normal slinging situations only four are used. Vertical loading was applied to all slinging provisions. MIL-STD-2096 requires a load factor of 2.3 to be applied at an angle of 45 degrees to the provision. This test was not accomplished due to the lack of equipment heavy enough to achieve the applied load.

PART 5

TIEDOWN PROCEDURE

ASL TIE DOWNS

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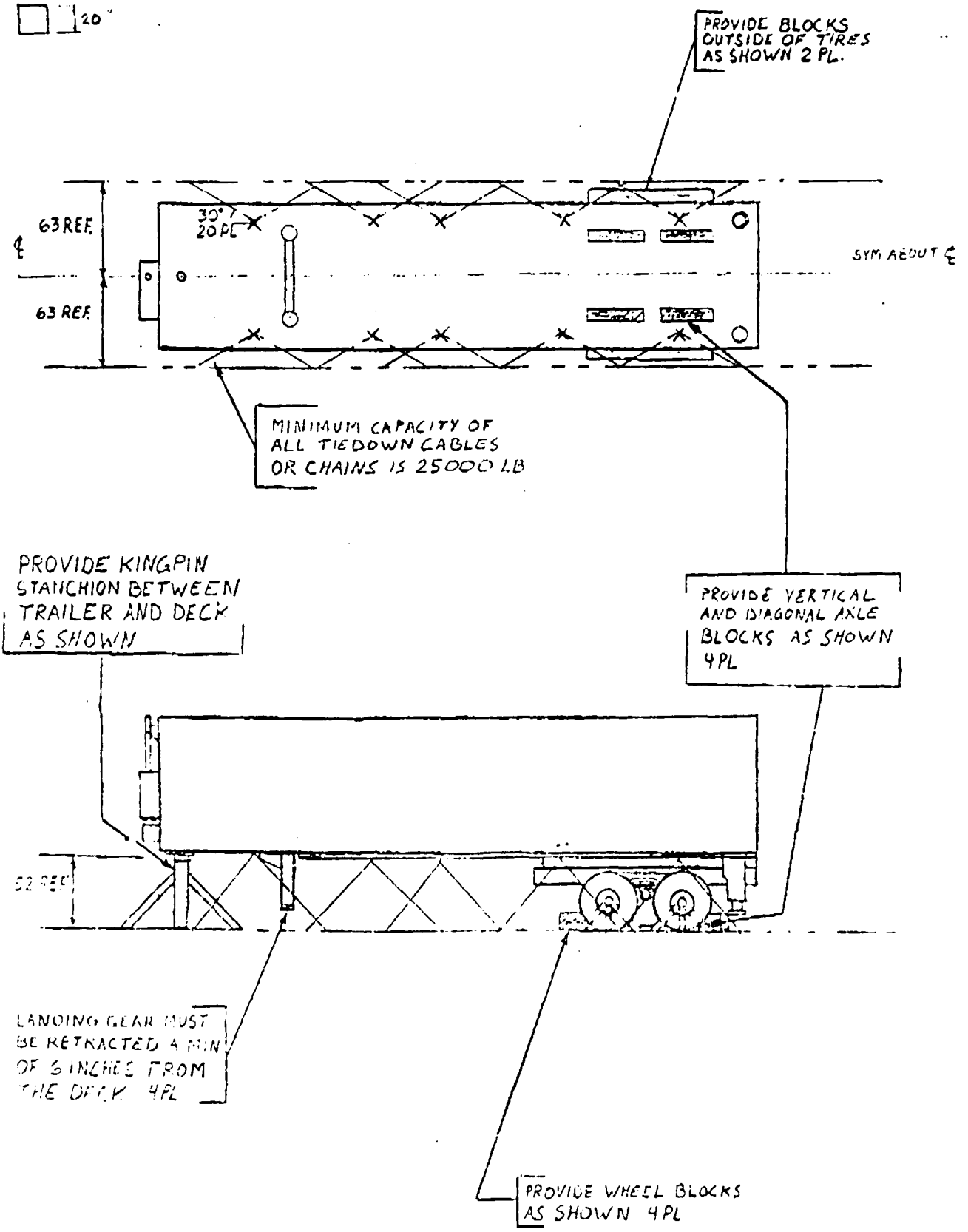
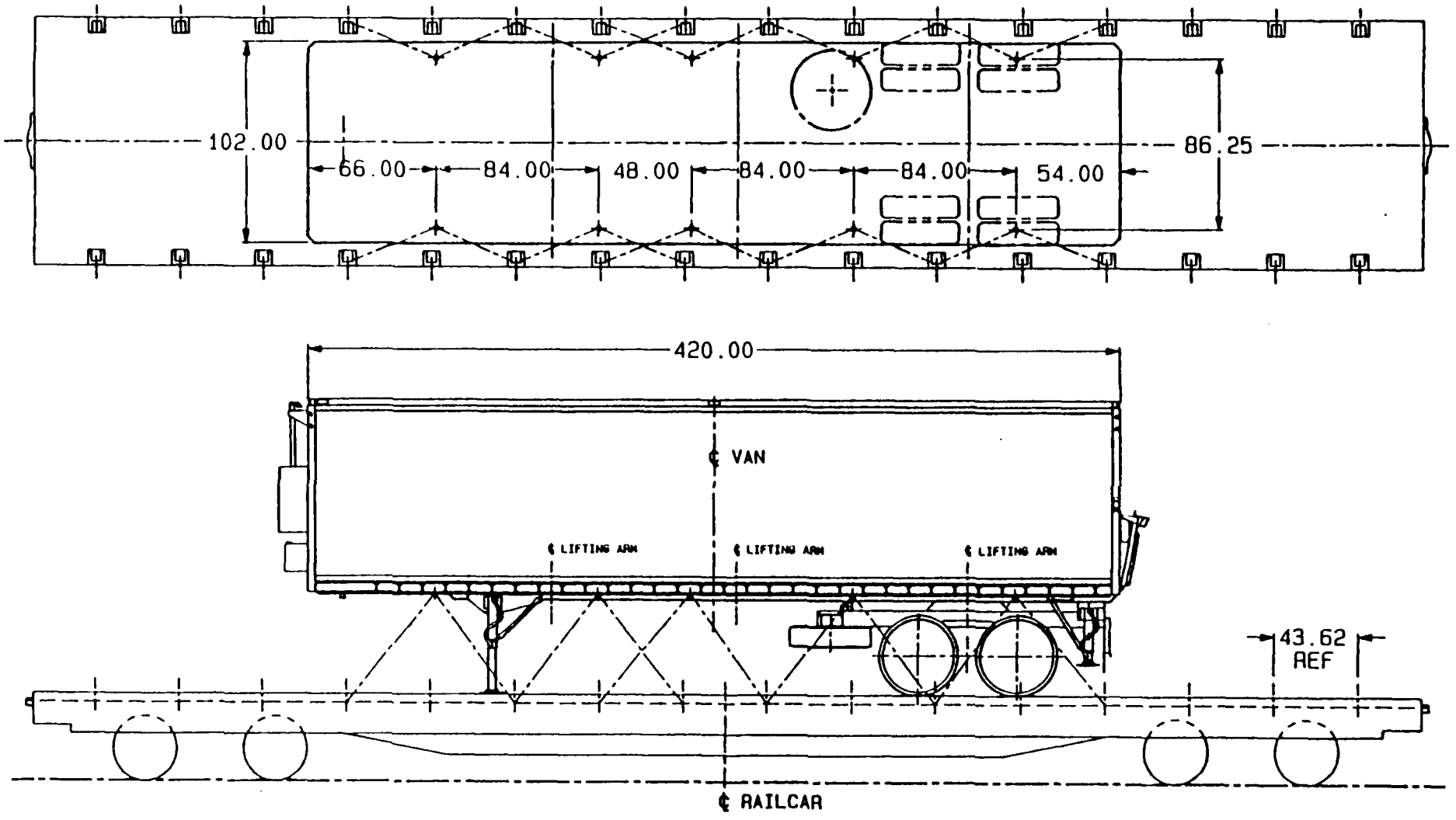


NOTE CABLE ANGLE MAY VARY BETWEEN 30° AND 45°



ASL VAN ON FLATCAR
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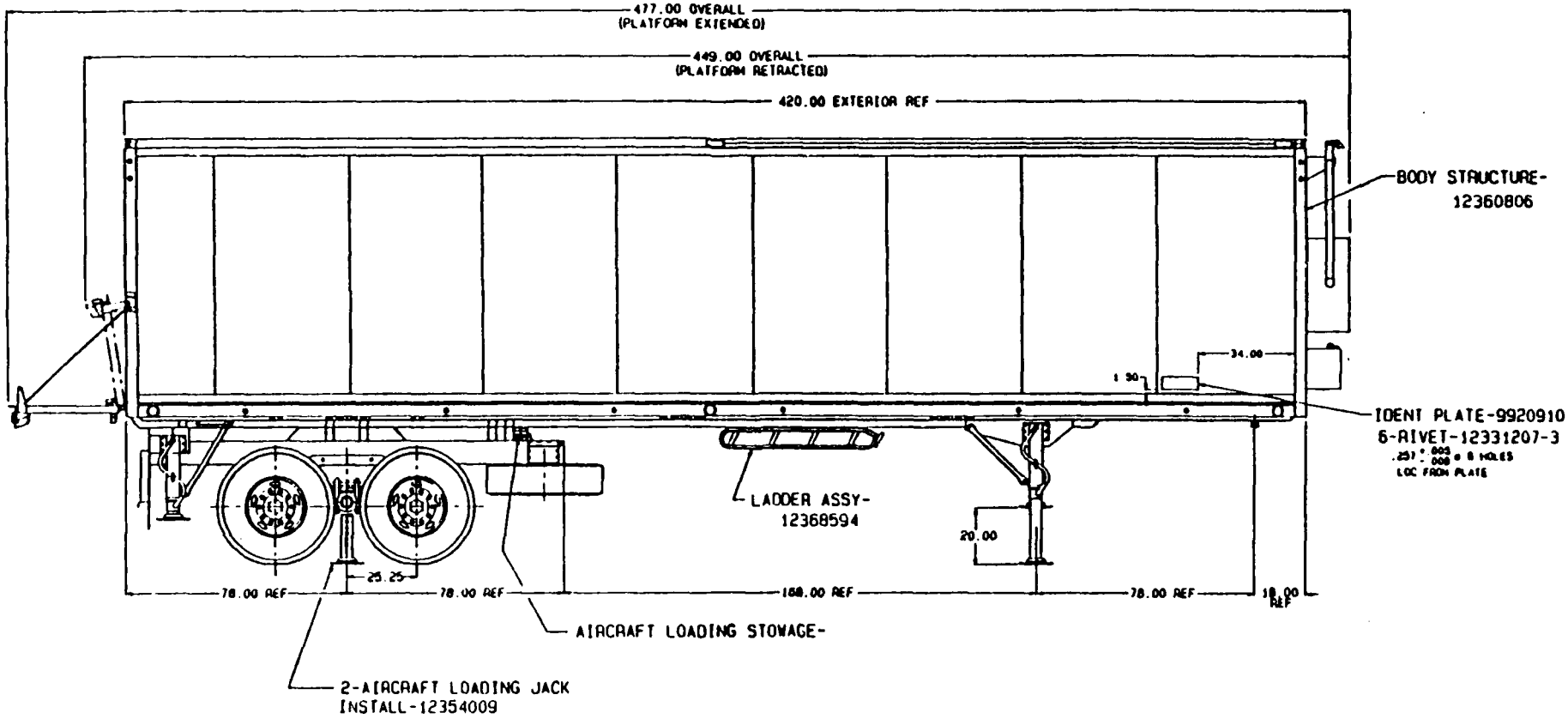

PART NO. 999-054790

U.S. ARMY TANK AUTOMOTIVE CO

SEMITRAILER, VAN, 12-TO
4-WHEEL, TACTICAL, ASL

DAAE07-88-C-R187

F | 19207 | 9920915

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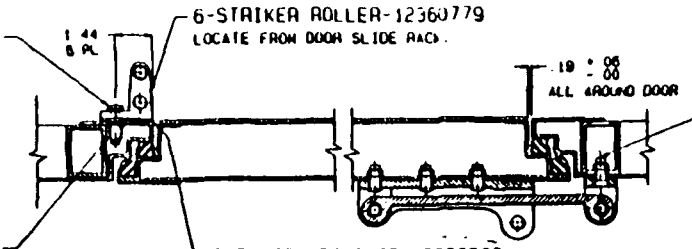

SECTION A-A
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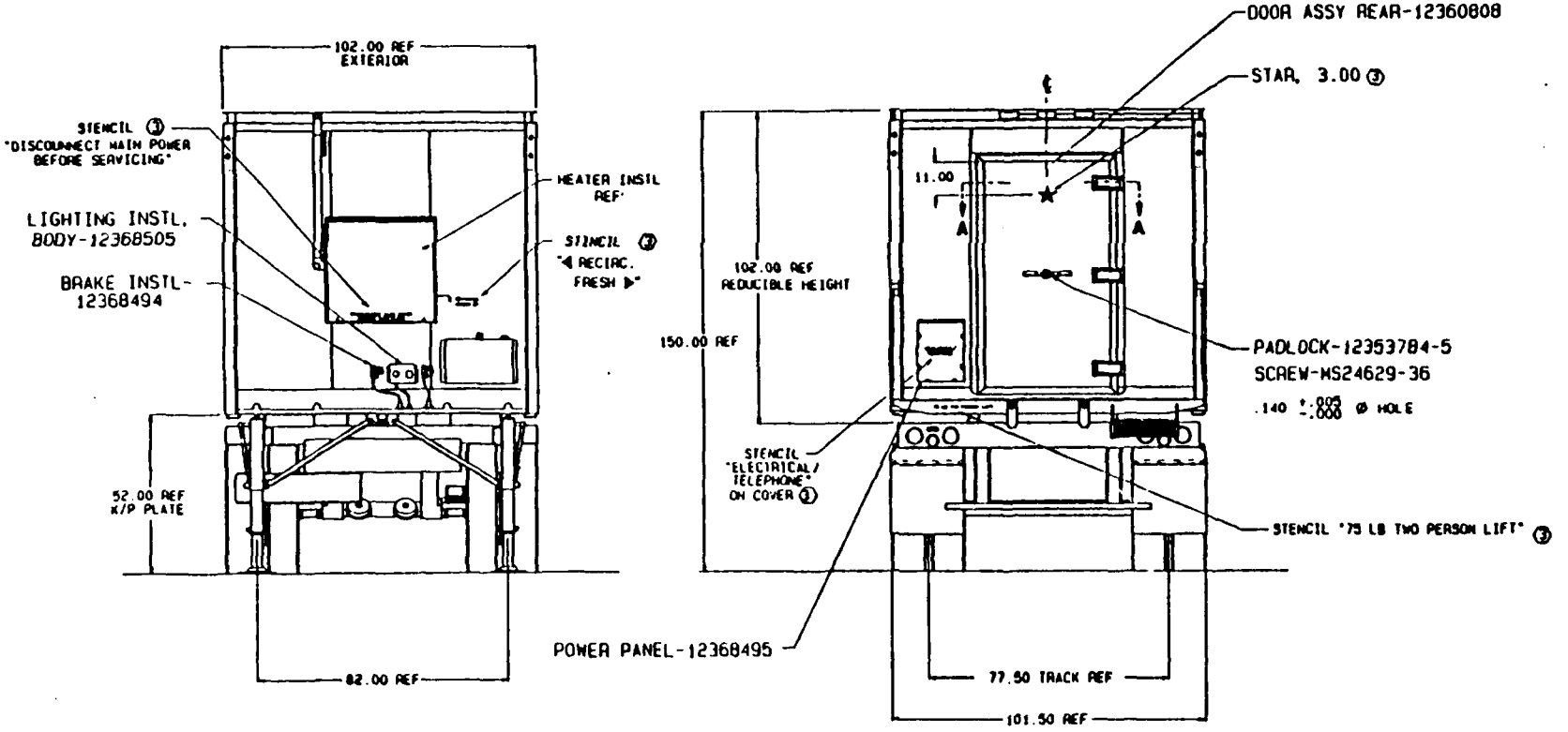


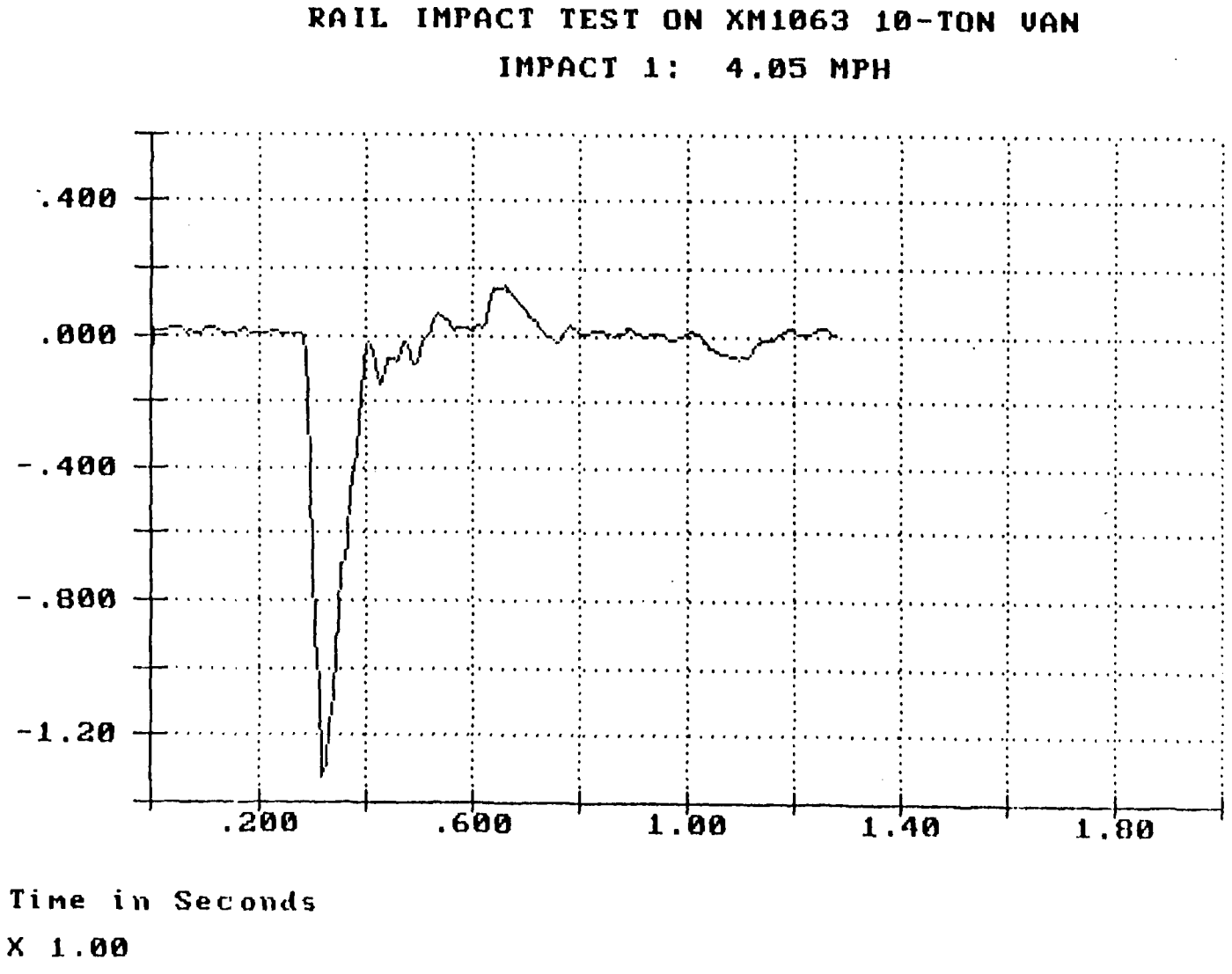
PART NO. 999-054790

		DAAE07-88-C-R167	U.S. ARMY TANK AUTOMOTIVE COMMAND
			SEMITRAILER, VAN, 12-TON 4-WHEEL; TACTICAL, ASL XM1063A2
			F 19207 9920915

8 7 6 5 4 3 2 1

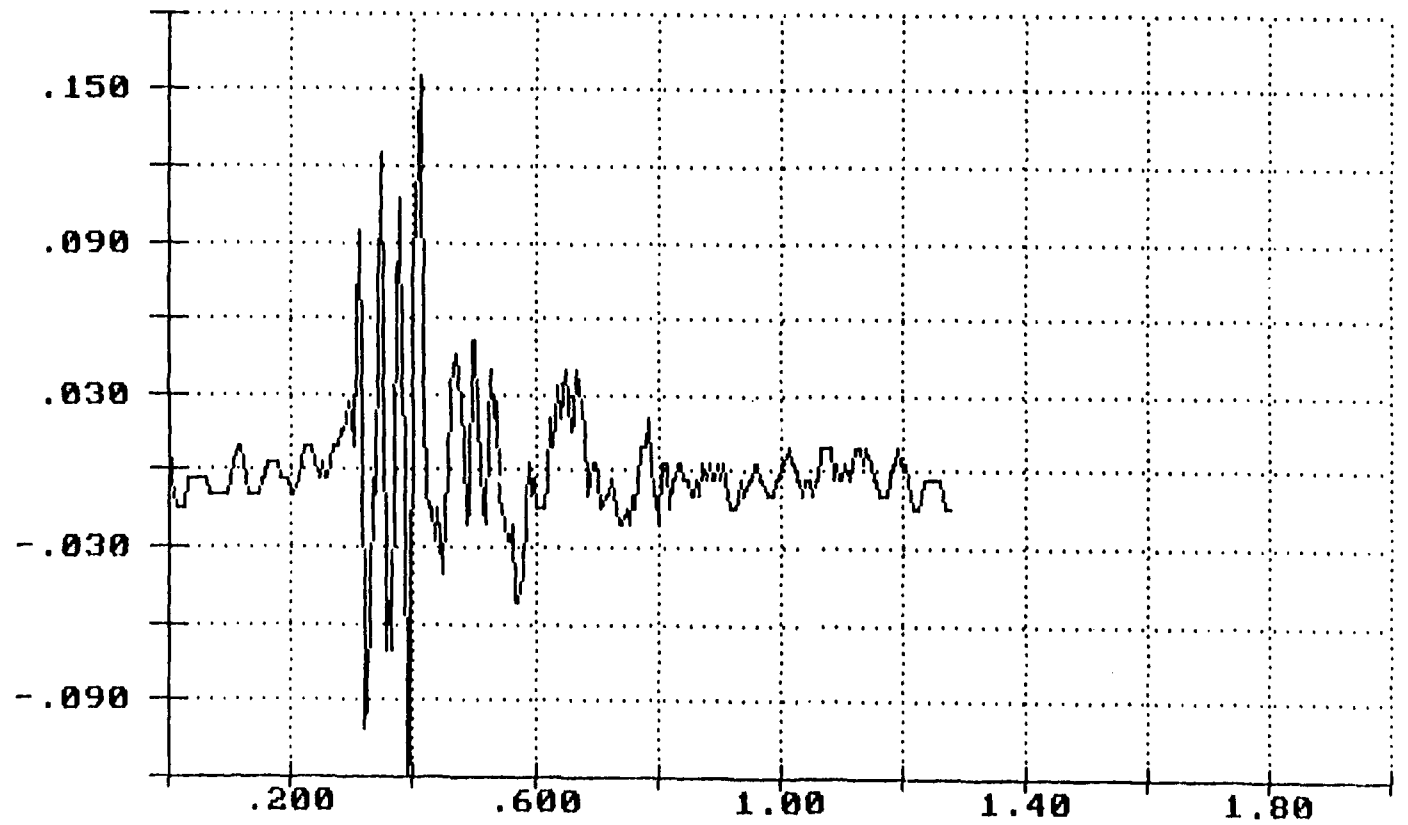
PART 6

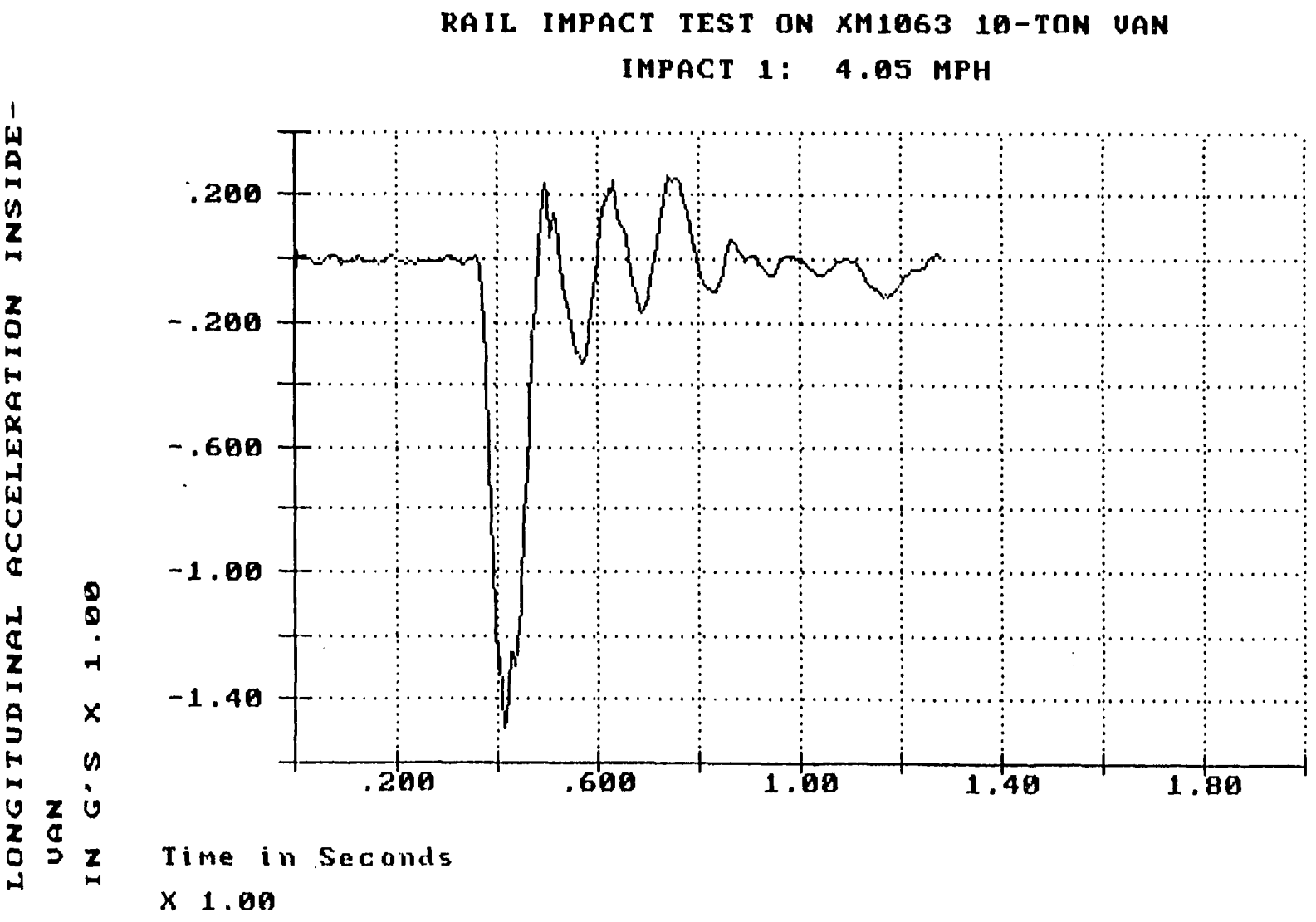
RAIL IMPACT DATA


RAIL IMPACT TEST ON XM1063 10-TON VAN
IMPACT 1: 4.05 MPH
.400
.000
-.400
-.800
-1.20
.200
.600
1.00
1.40
1.80
Time in Seconds
X 1.00
LONGITUDINAL ACCELERATION ON DOLLY FRONT LY IN G'S X 1.00

RAIL IMPACT TEST ON XM1063 10-TON VAN

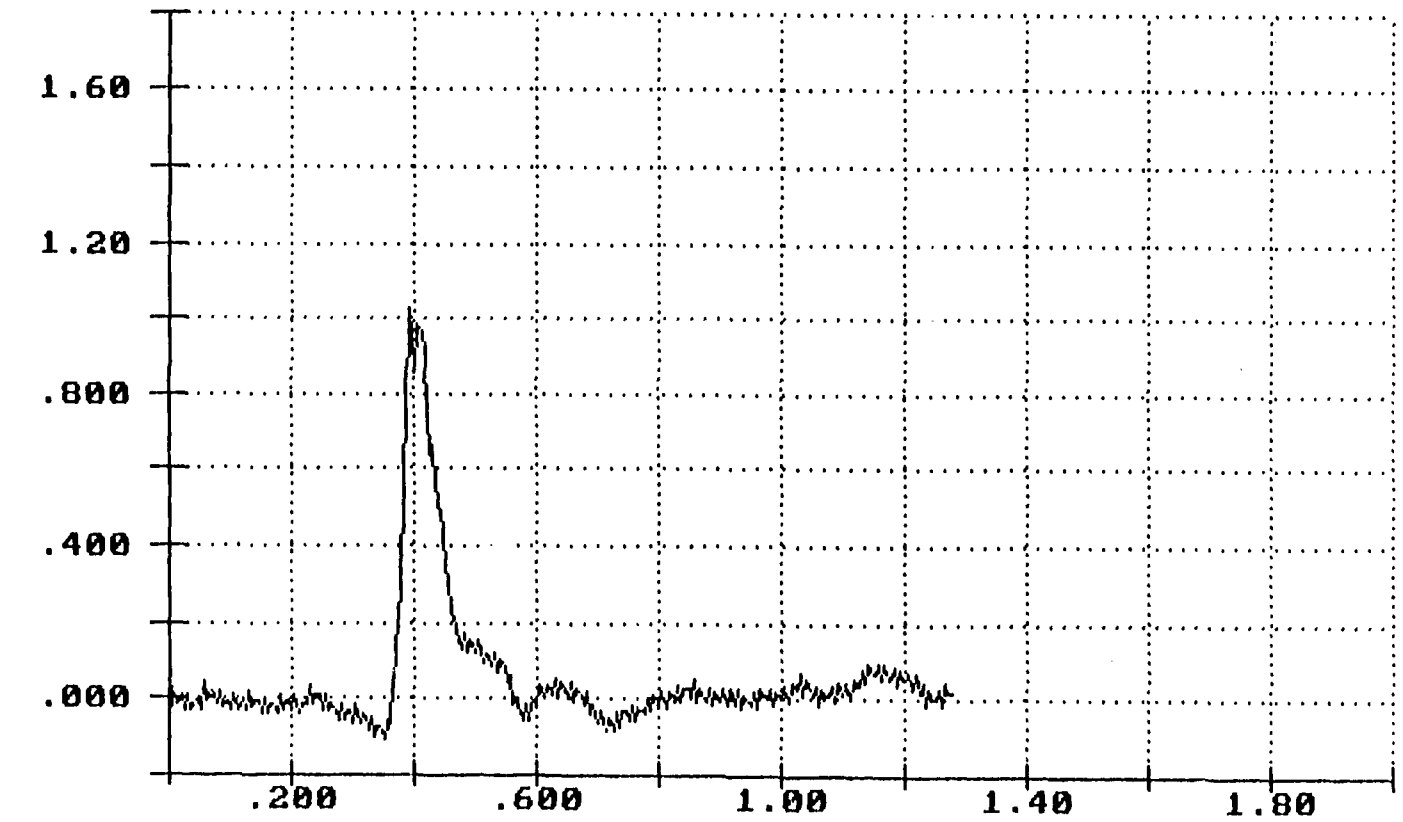
IMPACT 1: 4.05 MPH




RAIL IMPACT TEST ON XM1063 10-TON VAN
IMPACT 1: 4.05 MPH
LONGITUDINAL ACCELERATION INSIDE-VAN
IN G'S X 1.00
.200
-.200
-.600
-1.00
-1.40
.200
.600
1.00
1.40
1.80
Time in Seconds
X 1.00

RAIL IMPACT TEST ON XM1063 10-TON VAN

IMPACT 1: 4.05 MPH



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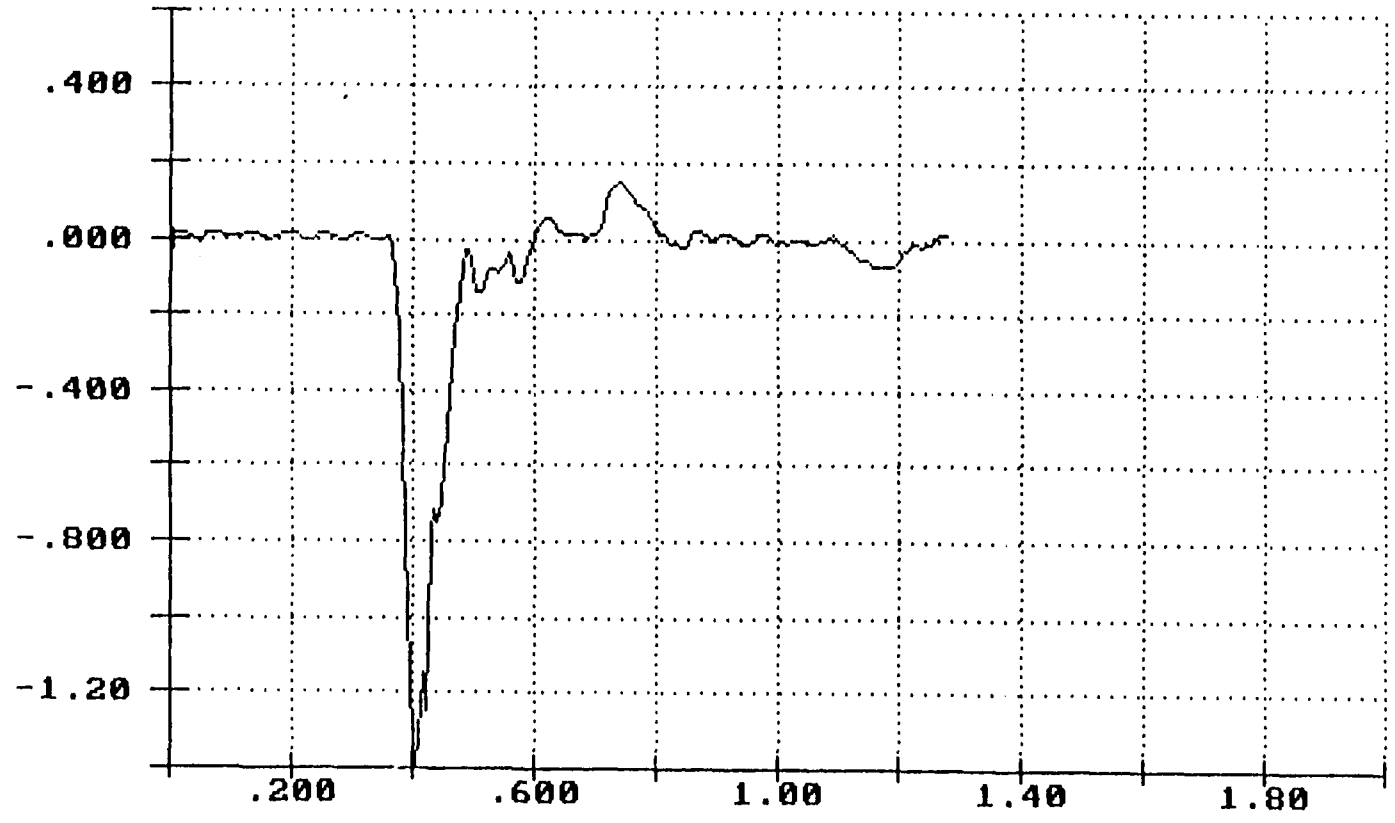
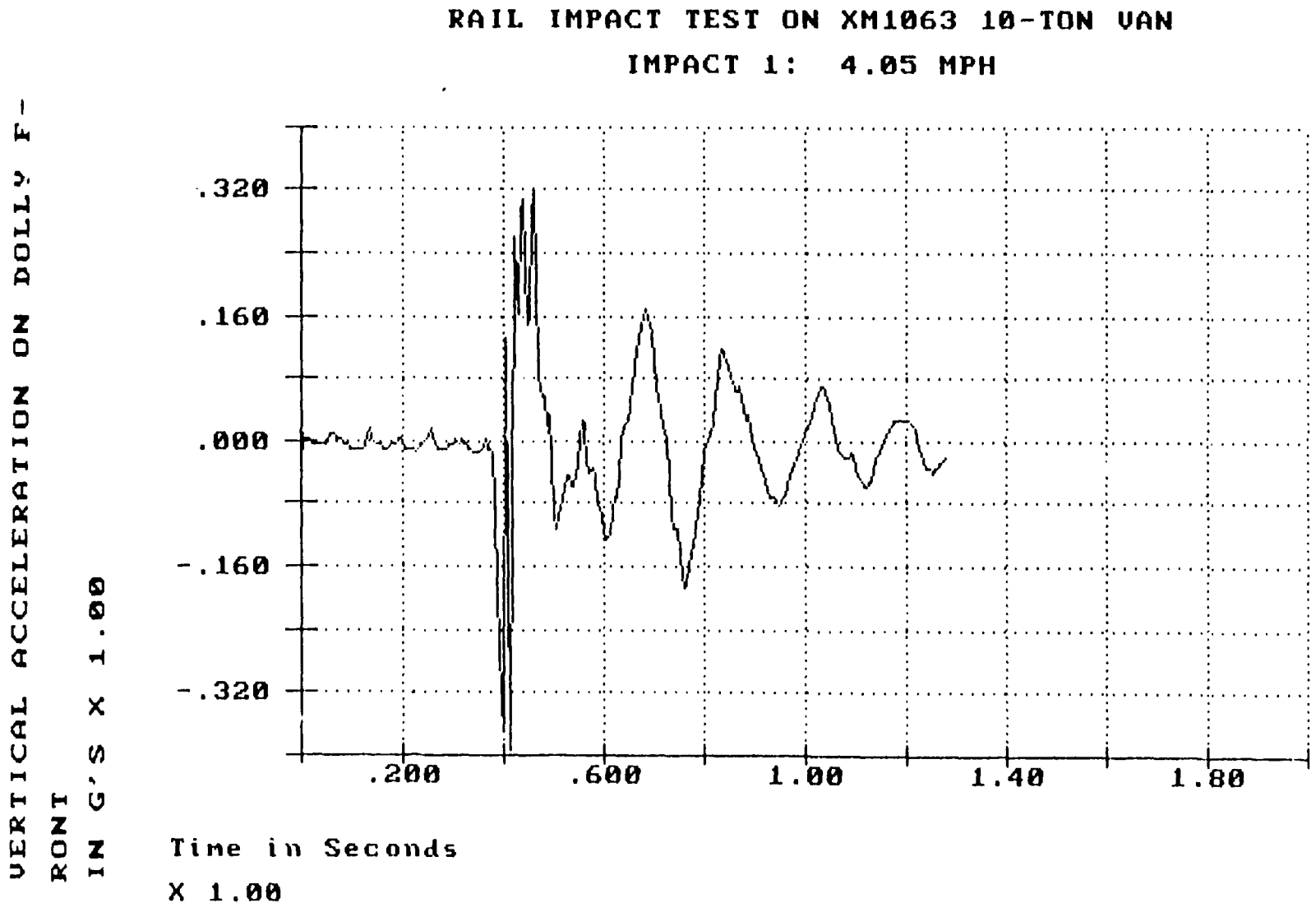


LONGITUDINAL ACCELERATION ON FRAME IN G'S X 1.00

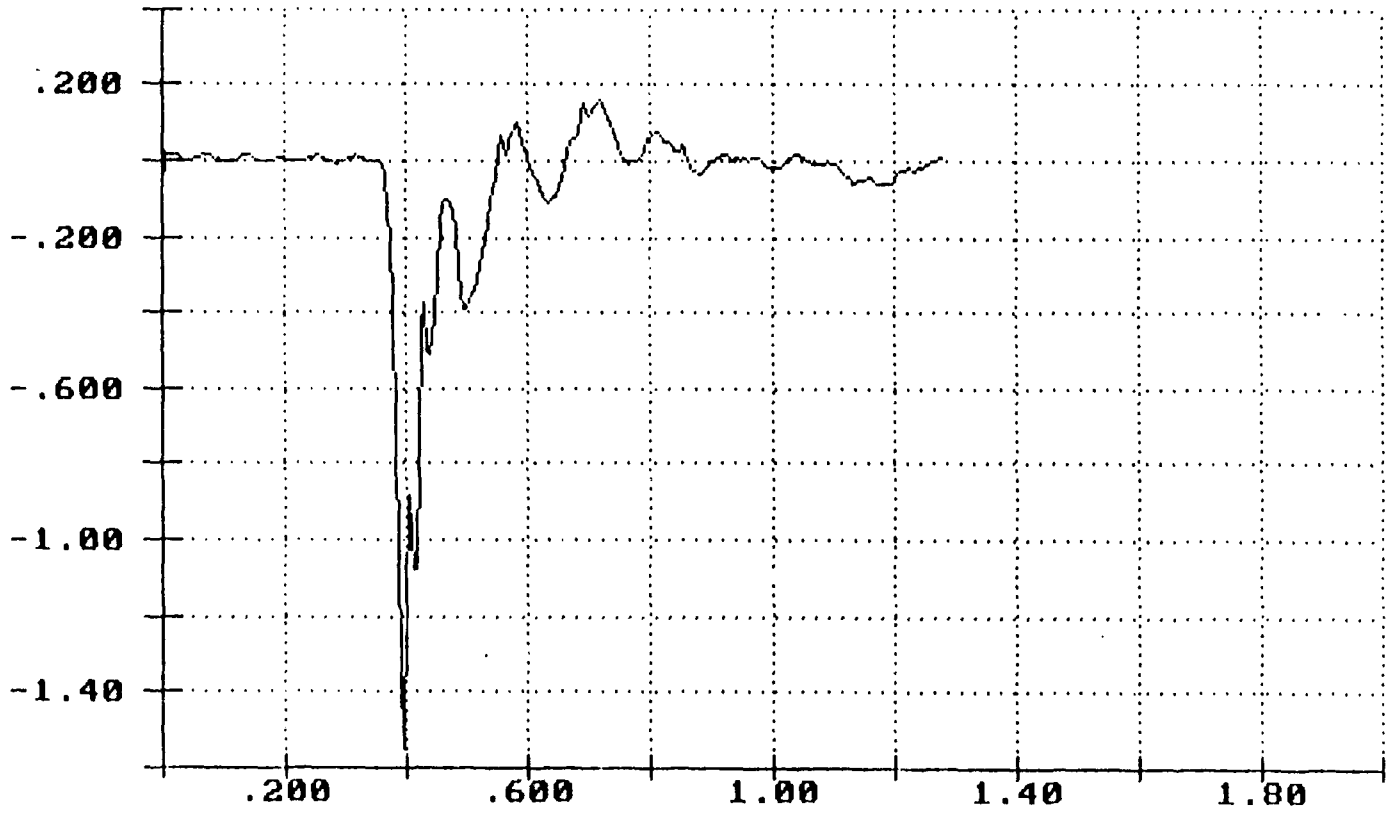
Time in Seconds

X 1.00


RAIL IMPACT TEST ON XM1063 10-TON VAN
IMPACT 1: 4.05 MPH
VERTICAL ACCELERATION ON DOLLY F-RONT
IN G'S X 1.00
.320
.160
.000
-.160
-.320
.200
.600
1.00
1.40
1.80
Time in Seconds
X 1.00

RAIL IMPACT TEST ON XM1063 10-TON VAN

IMPACT 1: 4.05 MPH



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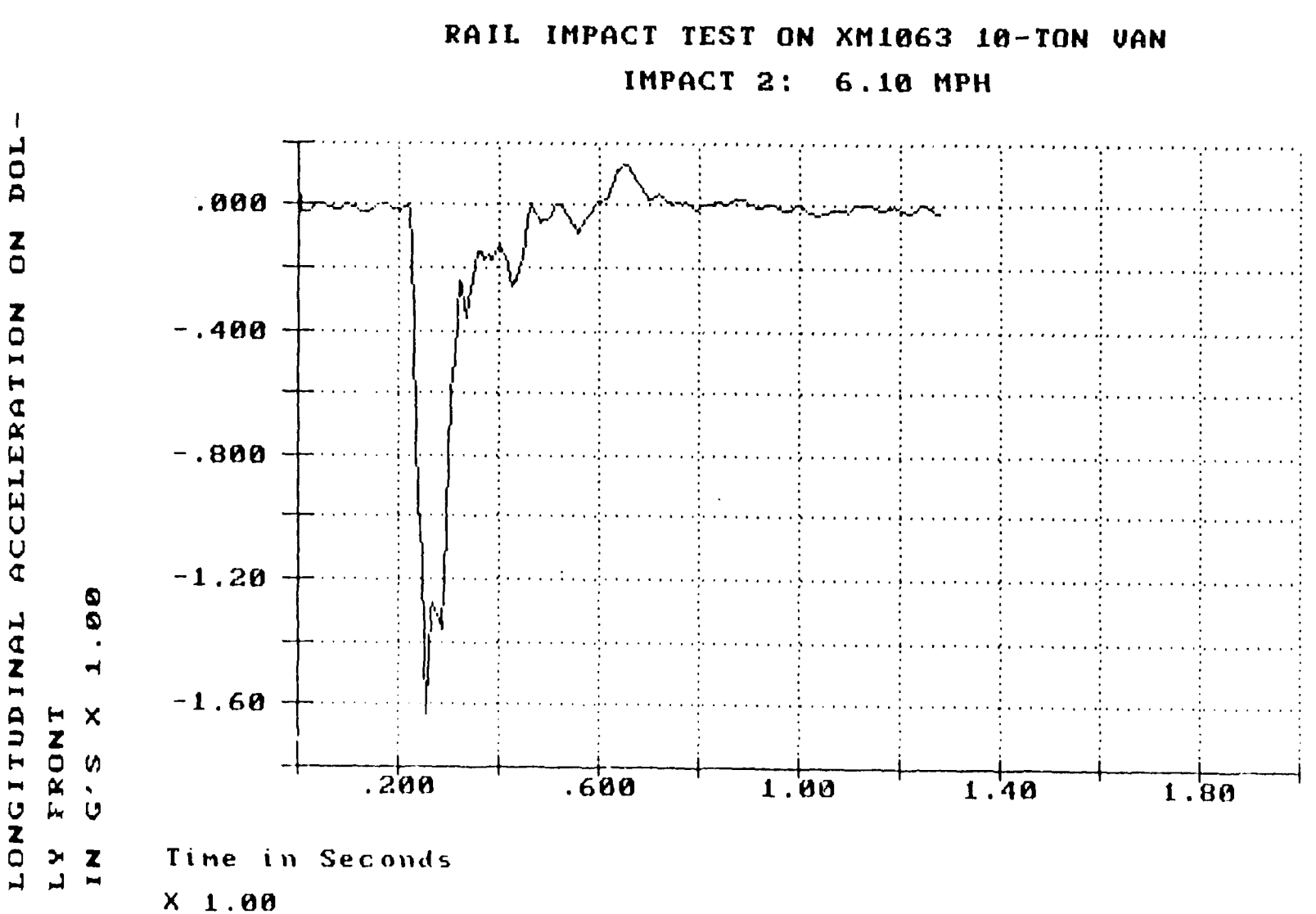
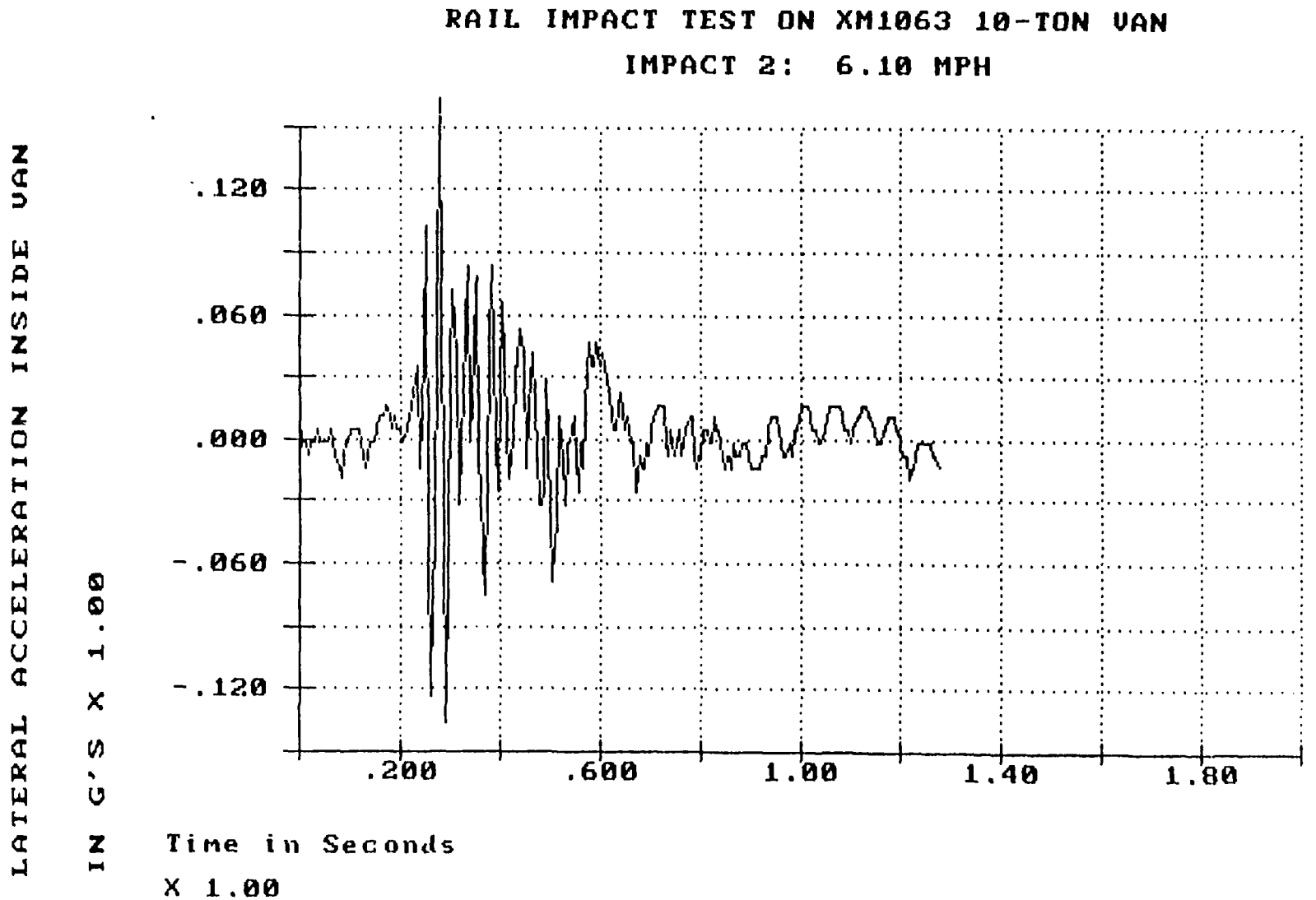
Time in Seconds

X 1.00


RAIL IMPACT TEST ON XM1063 10-TON VAN
IMPACT 2: 6.10 MPH
LONGITUDINAL ACCELERATION ON DOLLY FRONT IN G'S X 1.00
.000
-.400
-.800
-1.20
-1.60
.200
.600
1.00
1.40
1.80
Time in Seconds
X 1.00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IMPACT 2: 6.10 MPH
LATERAL ACCELERATION INSIDE VAN
IN G'S X 1.00
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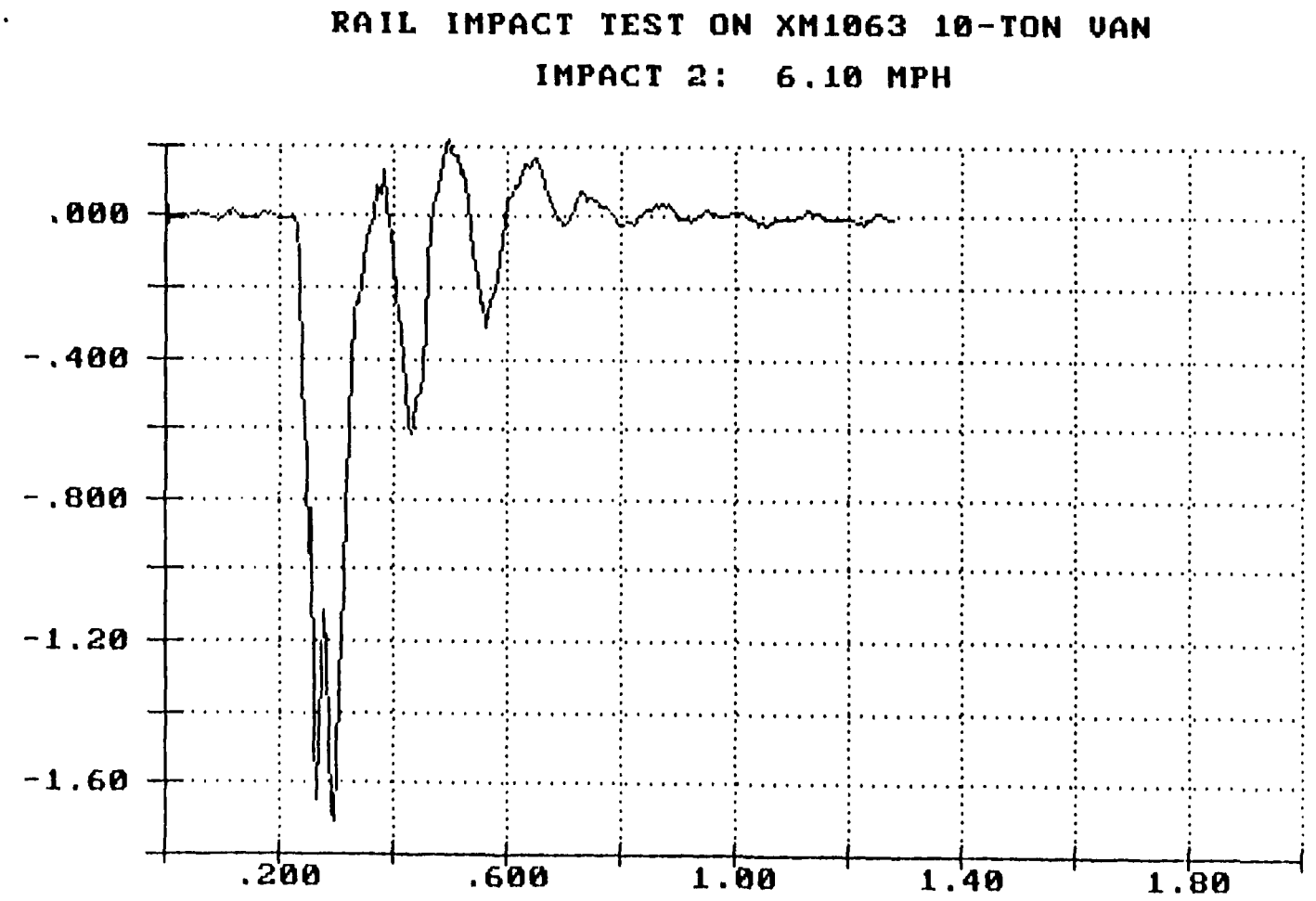
.060
.000
-.060
-.120
.200
.600
1.00
1.40
1.80
Time in Seconds
X 1.00


RAIL IMPACT TEST ON XM1063 10-TON VAN
IMPACT 2: 6.10 MPH
LONGITUDINAL ACCELERATION INSIDE-VAN
IN G'S X 1.00
.000
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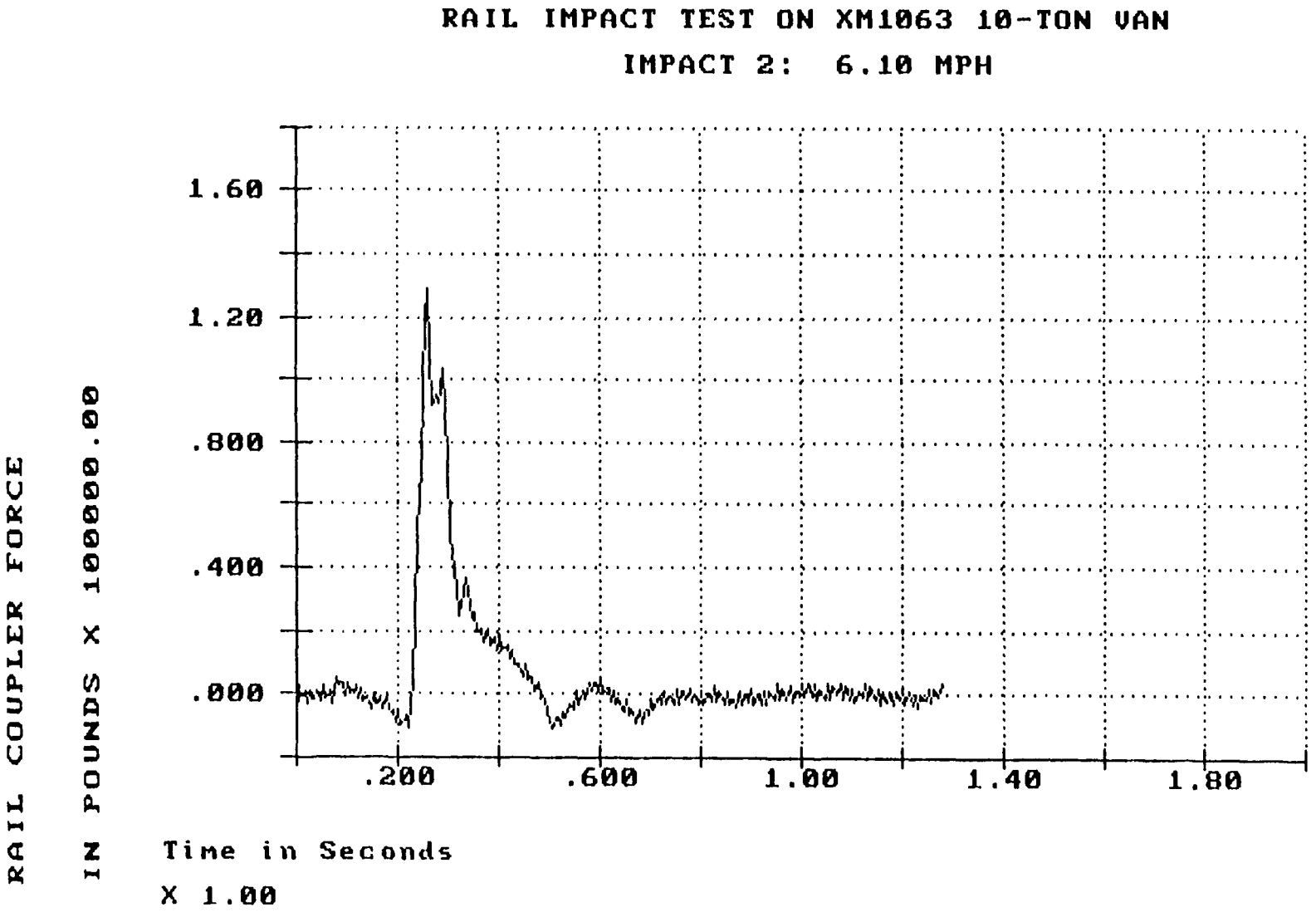
1.40
1.80
Time in Seconds
X 1.00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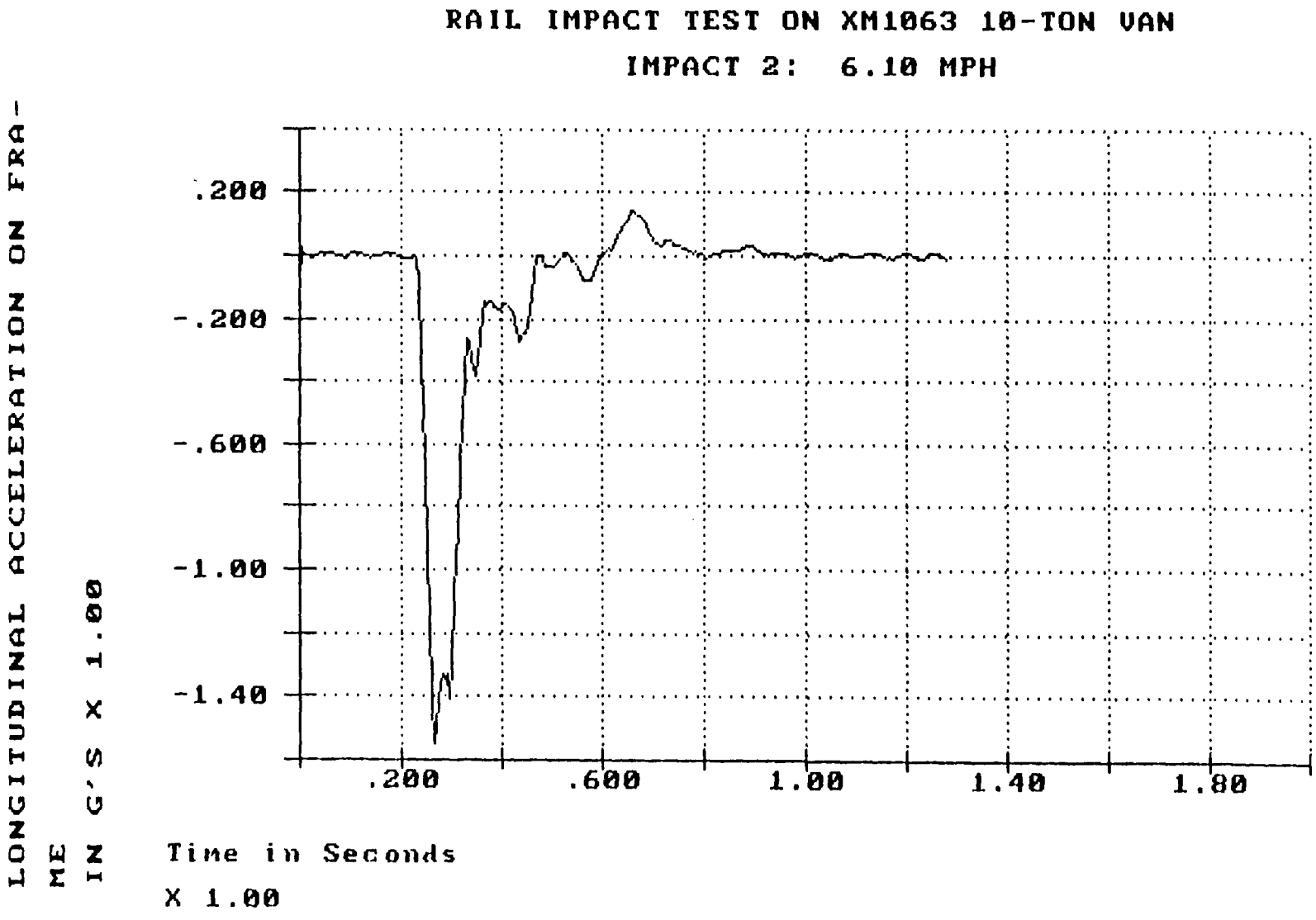
IMPACT 2: 6.10 MPH
1.60
1.20
.800
.400
.000
.200
.600
1.00
1.40
1.80
RAIL COUPLER FORCE
IN POUNDS X 100000.00
Time in Seconds
X 1.00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LONGITUDINAL ACCELERATION ON FRAME IN G'S X 1.00
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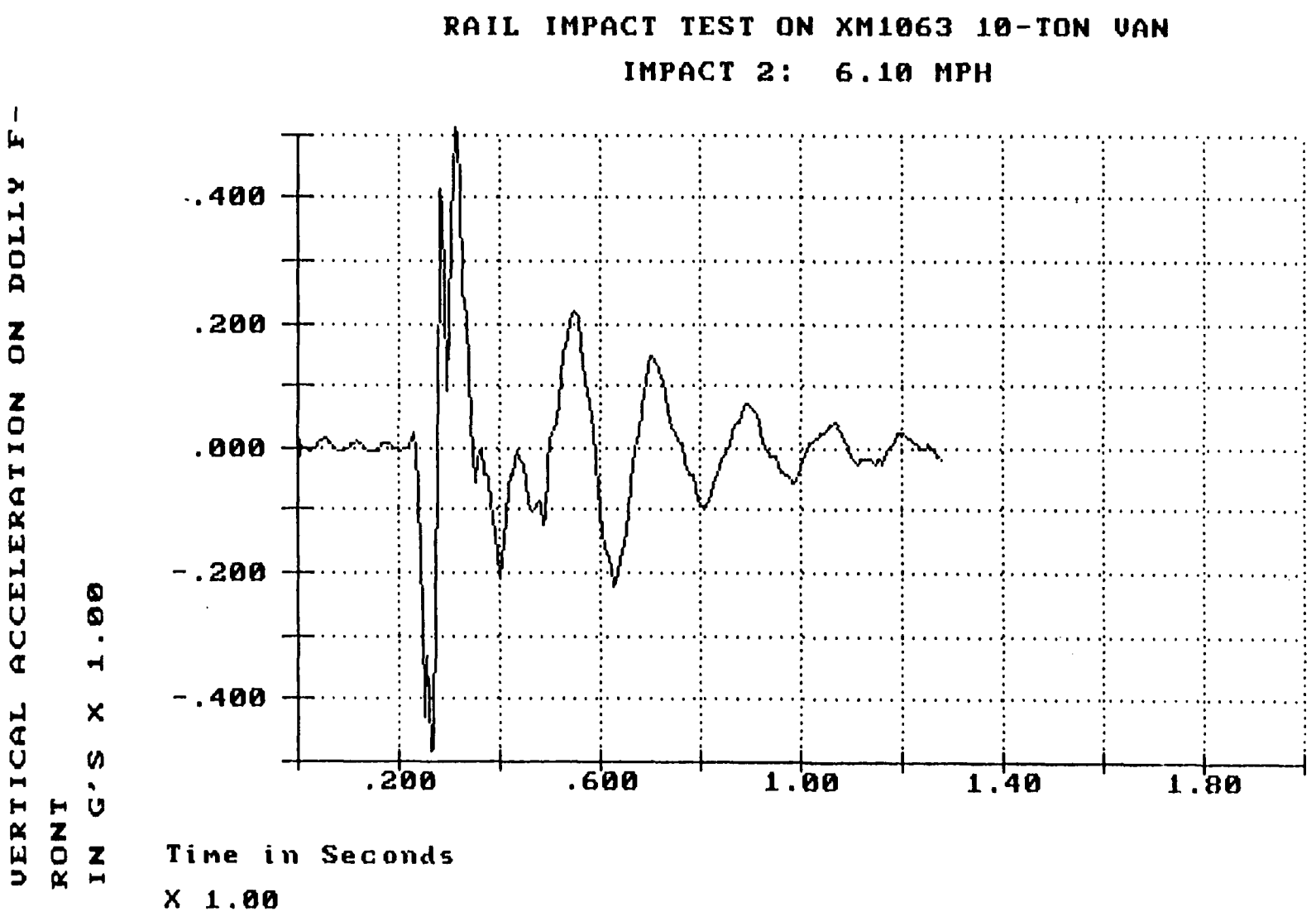
-.600
-1.00
-1.40
.200
.600
1.00
1.40
1.80
Time in Seconds
X 1.00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IMPACT 2: 6.10 MPH
VERTICAL ACCELERATION ON DOLLY F-
RONT
IN G'S X 1.00
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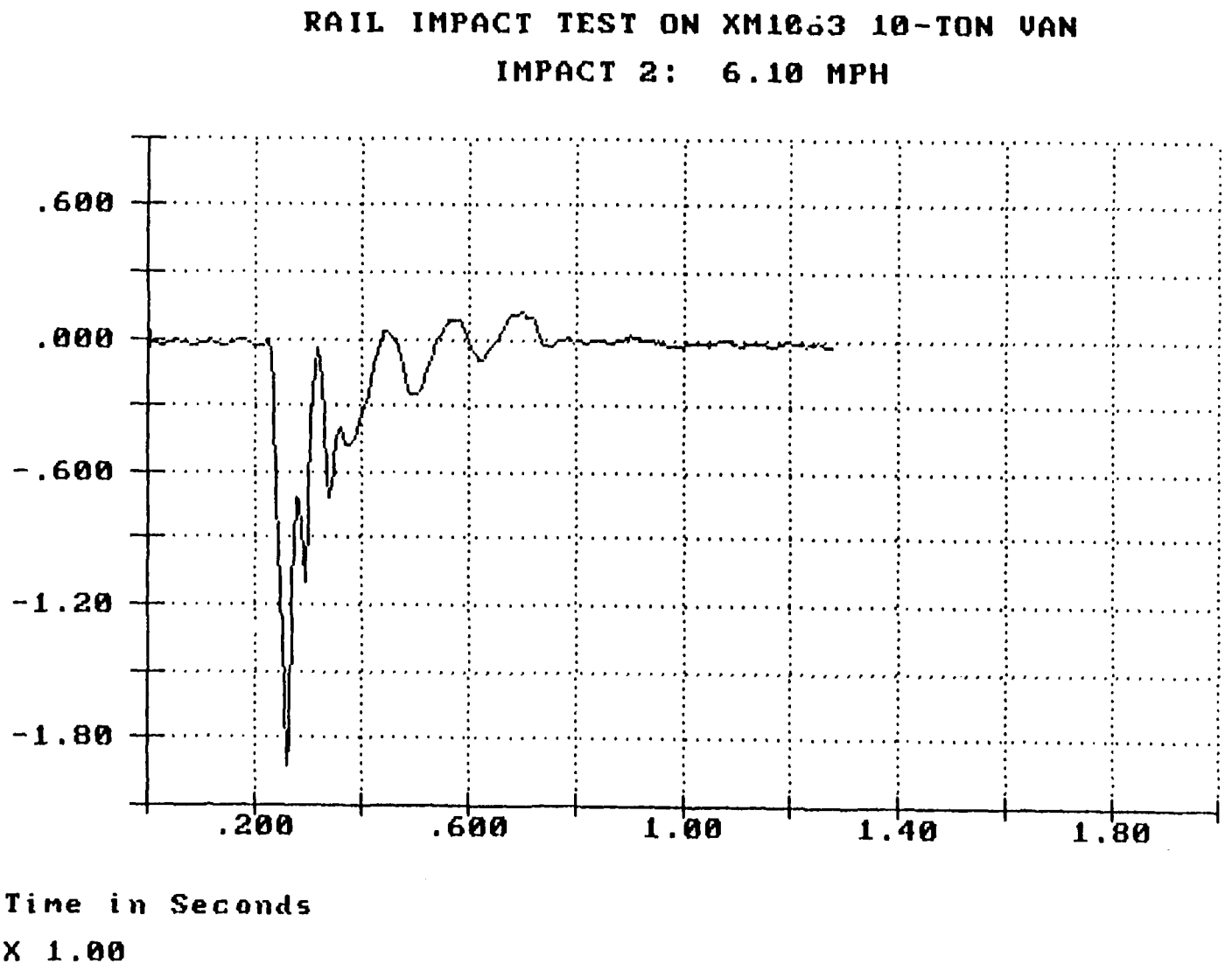
.200
.000
-.200
-.400
.200
.600
1.00
1.40
1.80
Time in Seconds
X 1.00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IMPACT 2: 6.10 MPH
.600
.000
-.600
-1.20
-1.80
.200
.600
1.00
1.40
1.80
LONGITUDINAL ACCELERATION ON CENTERSILL IN G'S X 1.00
Time in Seconds
X 1.00

RAIL IMPACT TEST ON XM1063 10-TON VAN

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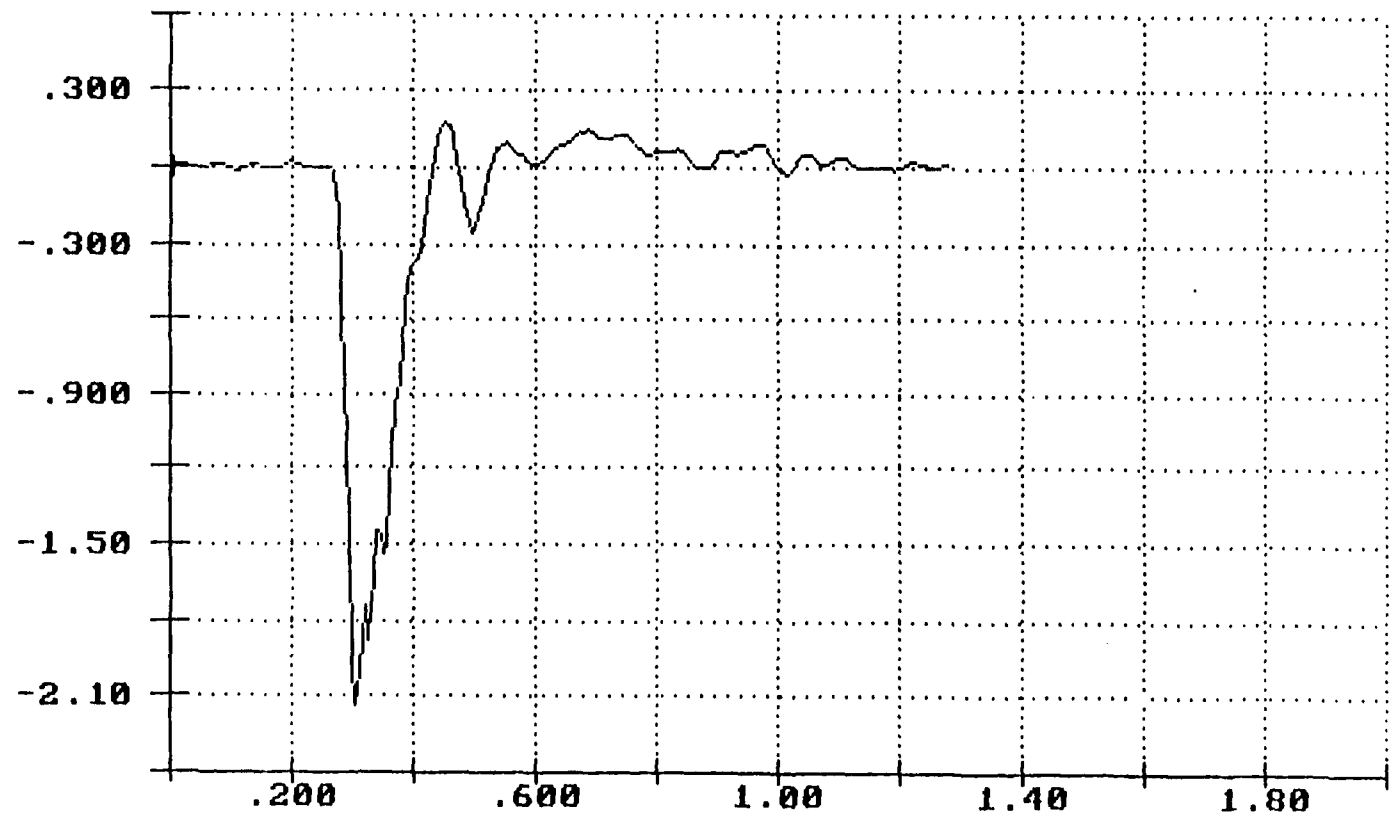
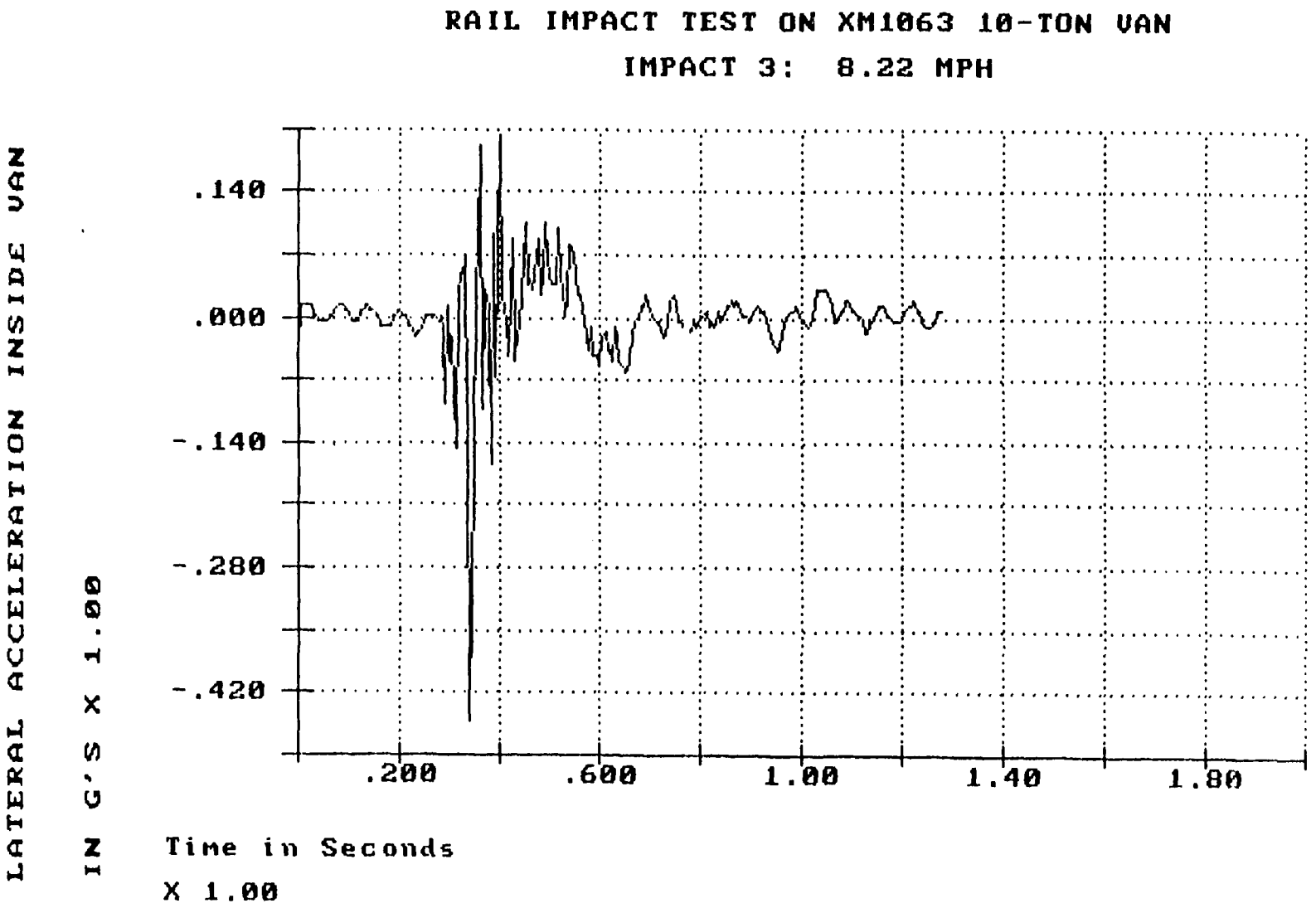
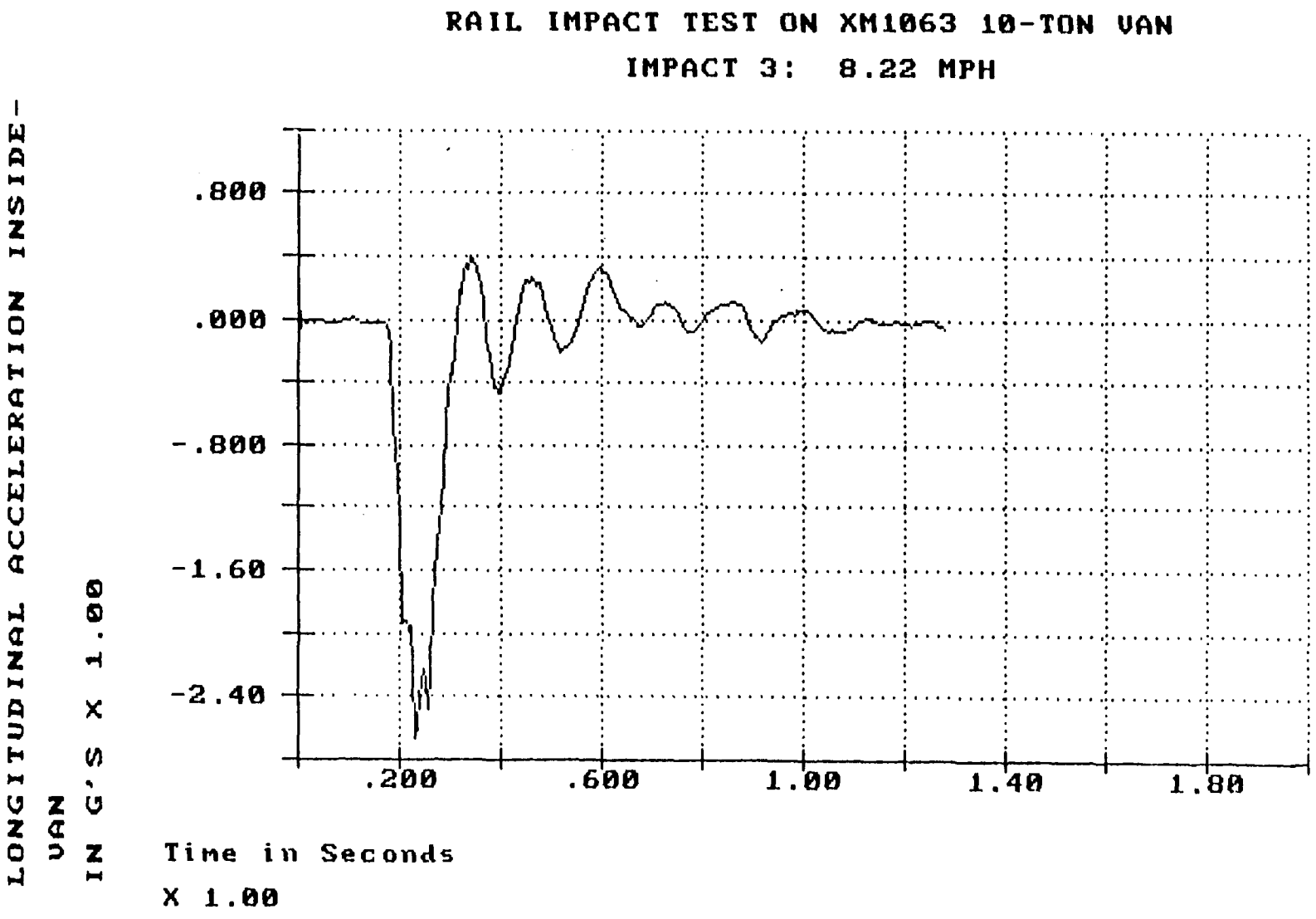


LONGITUDINAL ACCELERATION ON DOLLY FRONT IN G'S X 1.00

Time in Seconds

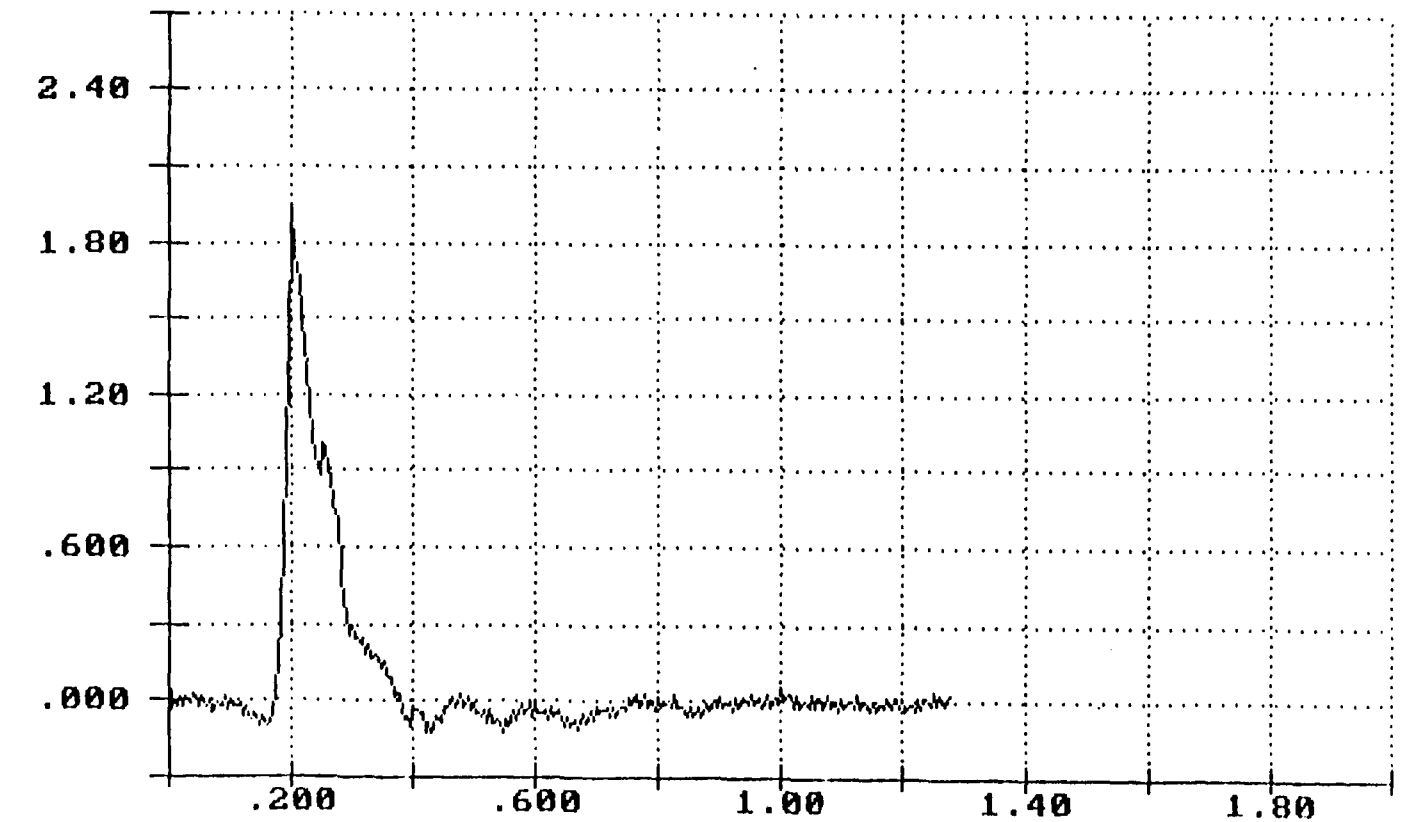
X 1.00


RAIL IMPACT TEST ON XM1063 10-TON VAN
IMPACT 3: 8.22 MPH
LATERAL ACCELERATION INSIDE VAN
IN G'S X 1.00
.140
.000
-.140
-.280
-.420
.200
.600
1.00
1.40
1.80
Time in Seconds
X 1.00


RAIL IMPACT TEST ON XM1063 10-TON VAN
IMPACT 3: 8.22 MPH
LONGITUDINAL ACCELERATION INSIDE-VAN
IN G'S X 1.00
.800
.000
-.800
-1.60
-2.40
.200
.600
1.00
1.40
1.80
Time in Seconds
X 1.00

RAIL IMPACT TEST ON XM1063 10-TON VAN

IMPACT 3: 8.22 MPH



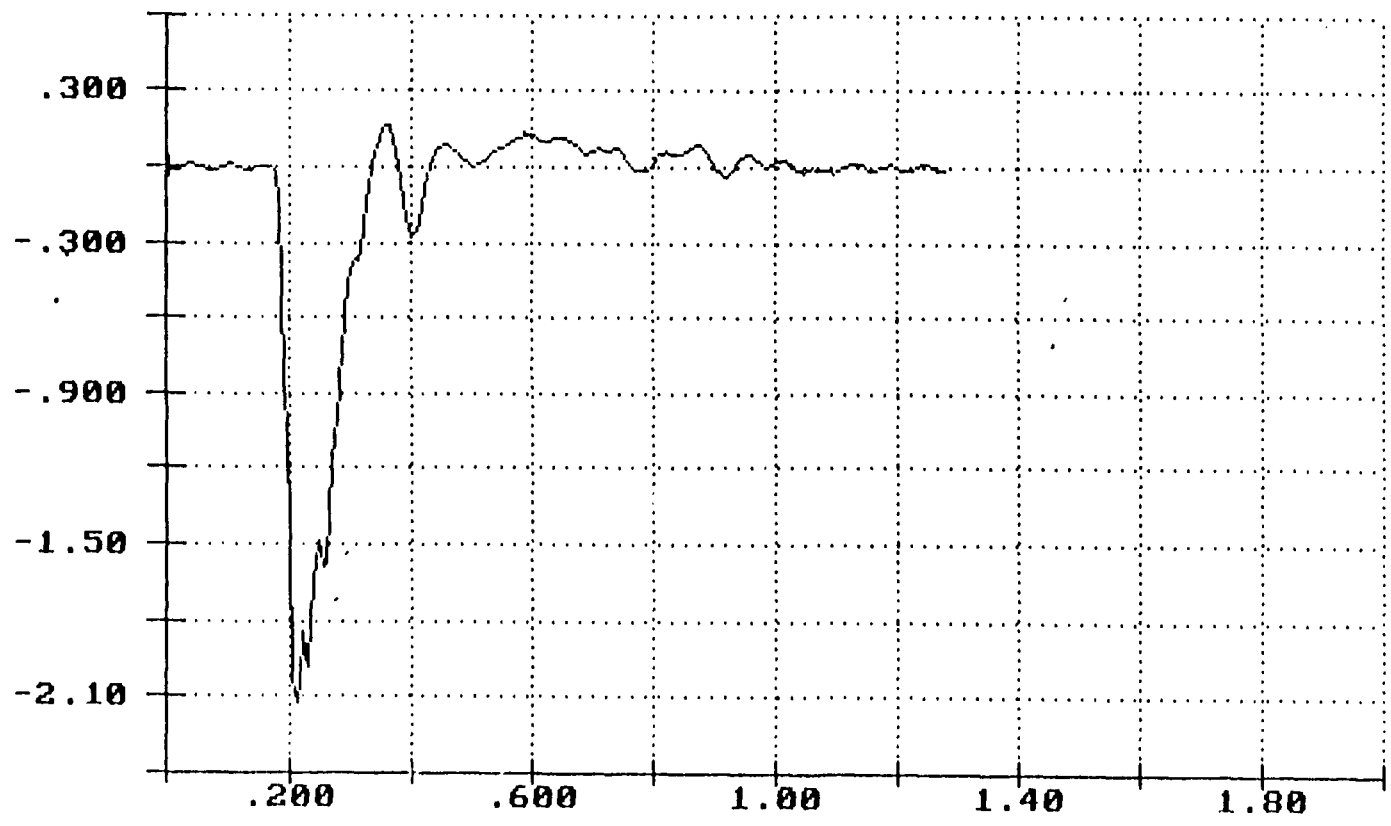
RAIL COUPLER FORCE IN POUNDS X 100000.00

Time in Seconds

X 1.00

RAIL IMPACT TEST ON XM1063 10-TON VAN

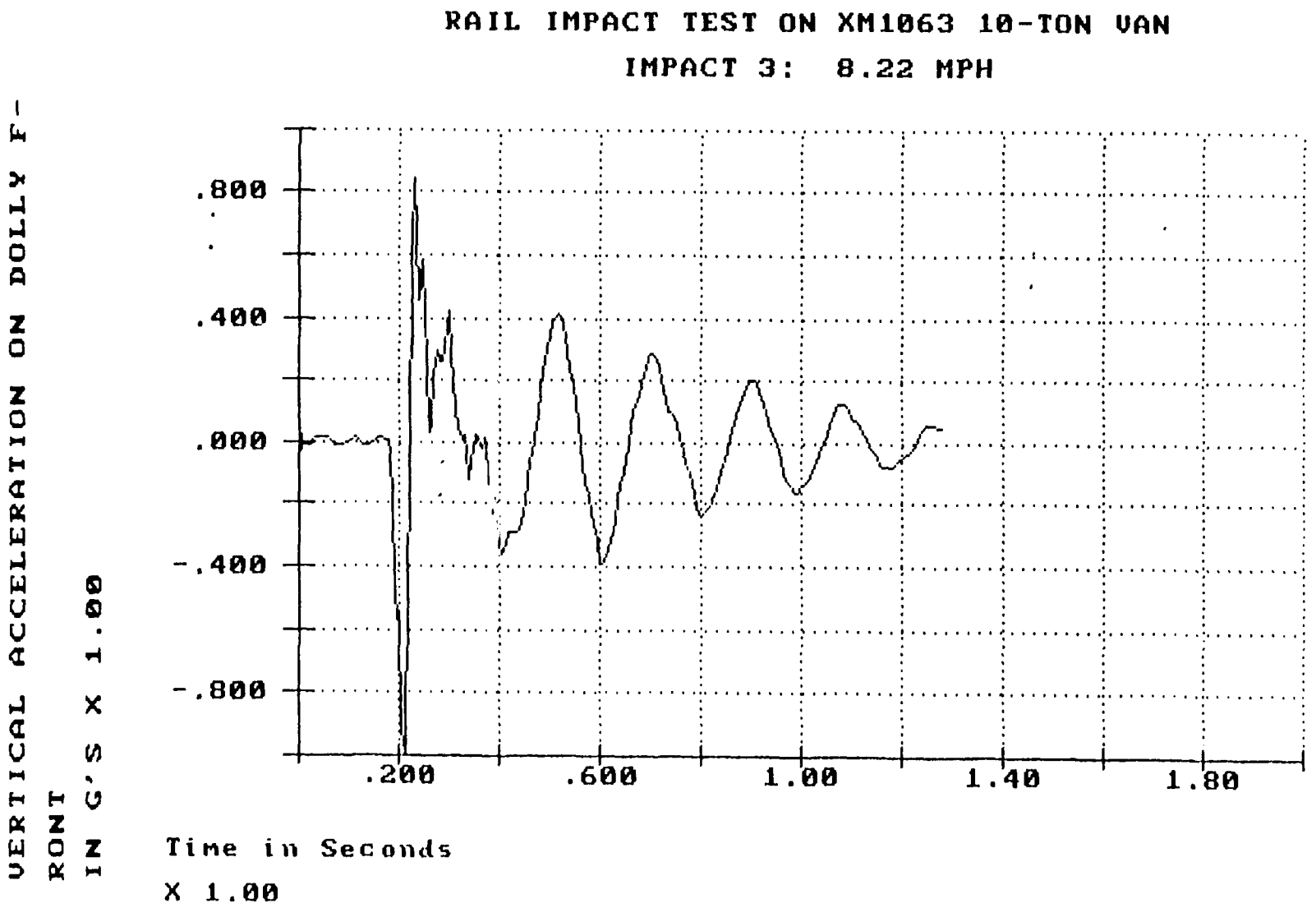
IMPACT 3: 8.22 MPH



LONGITUDINAL ACCELERATION ON FRAME IN G'S X 1.00

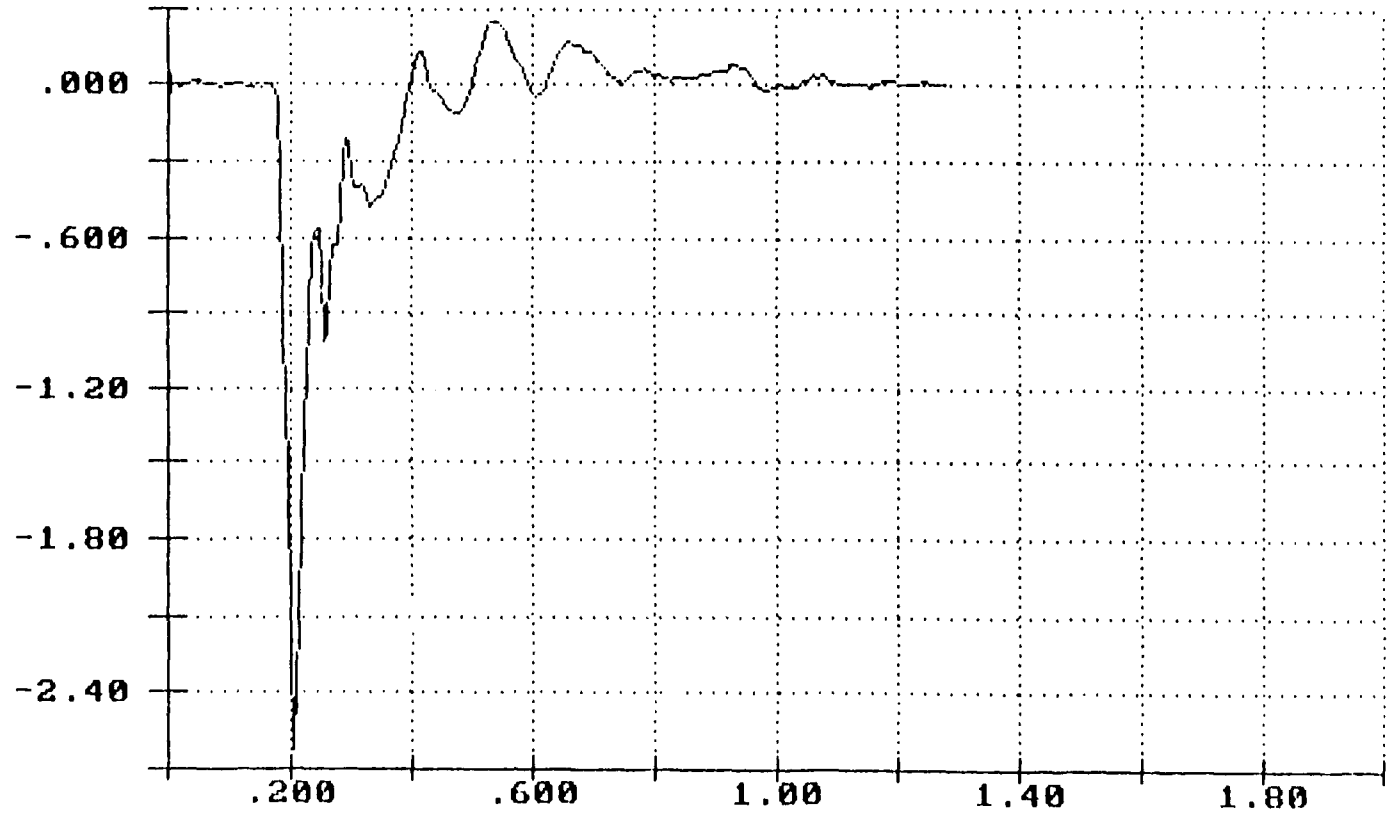
Time in Seconds

X 1.00


RAIL IMPACT TEST ON XM1063 10-TON VAN
IMPACT 3: 8.22 MPH
VERTICAL ACCELERATION ON DOLLY FRONT
IN G'S X 1.00
.800
.400
.000
-.400
-.800
.200
.600
1.00
1.40
1.80
Time in Seconds
X 1.00

RAIL IMPACT TEST ON XM1063 10-TON VAN

IMPACT 3: 8.22 MPH



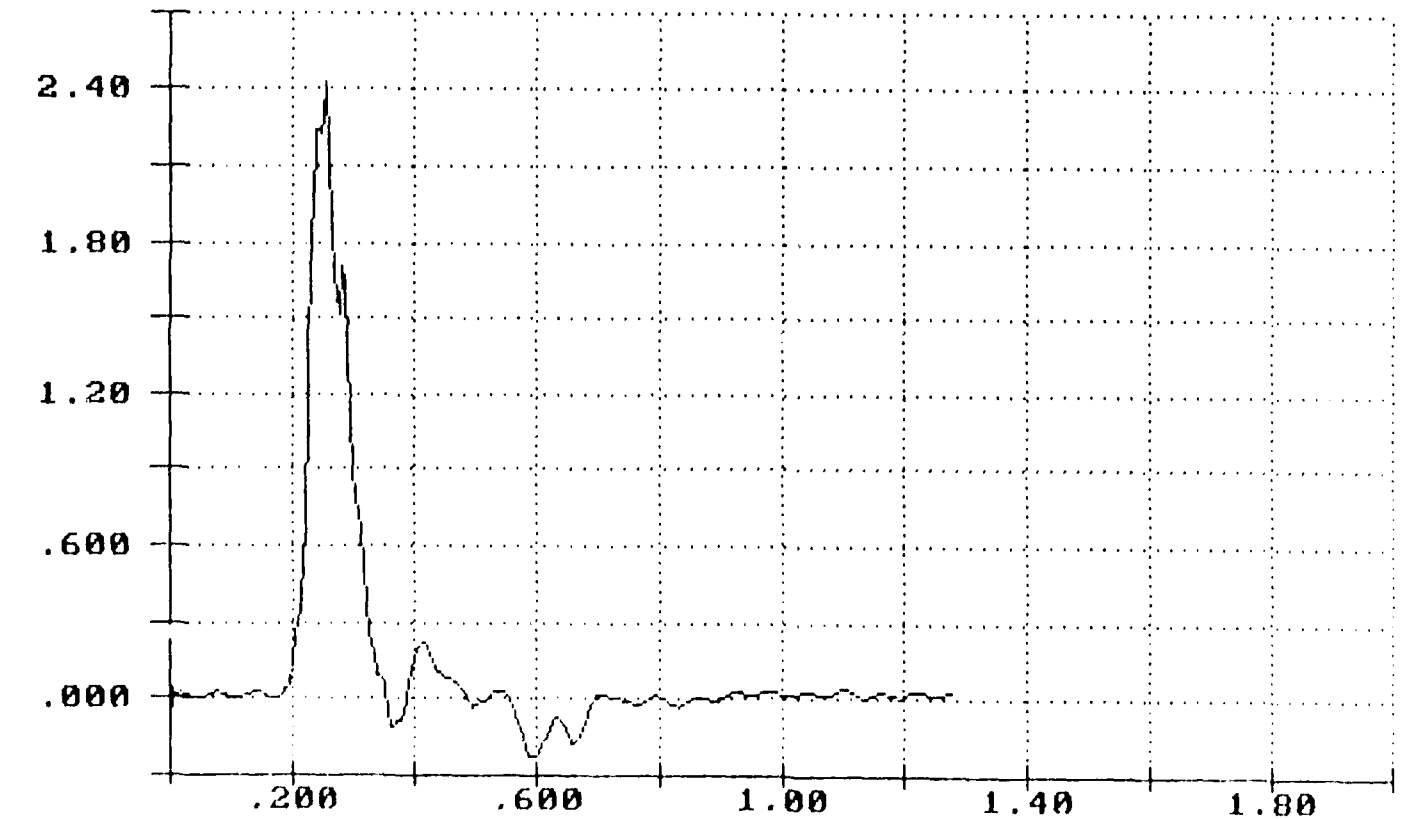
LONGITUDINAL ACCELERATION ON CENTERSILL IN G'S X 1.00

Time in Seconds

X 1.00

RAIL IMPACT TEST ON XM1063 10-TON VAN

IMPACT 4: 8.06 MPH REVERSE



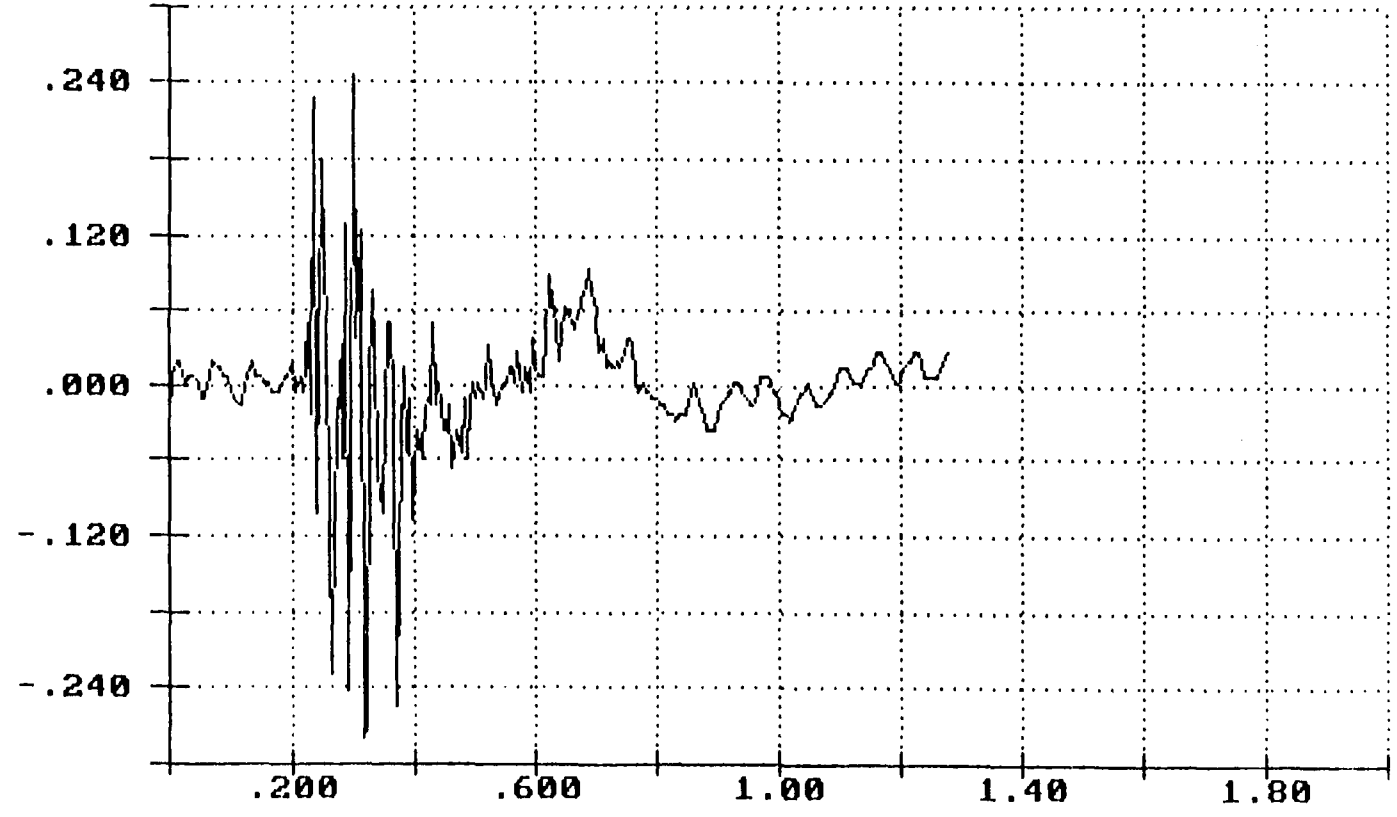
LONGITUDINAL ACCELERATION ON DOLLY FRONT IN G'S X 1.00

Time in Seconds

X 1.00

RAIL IMPACT TEST ON XM1063 10-TON VAN

IMPACT 4: 8.06 MPH REVERSE

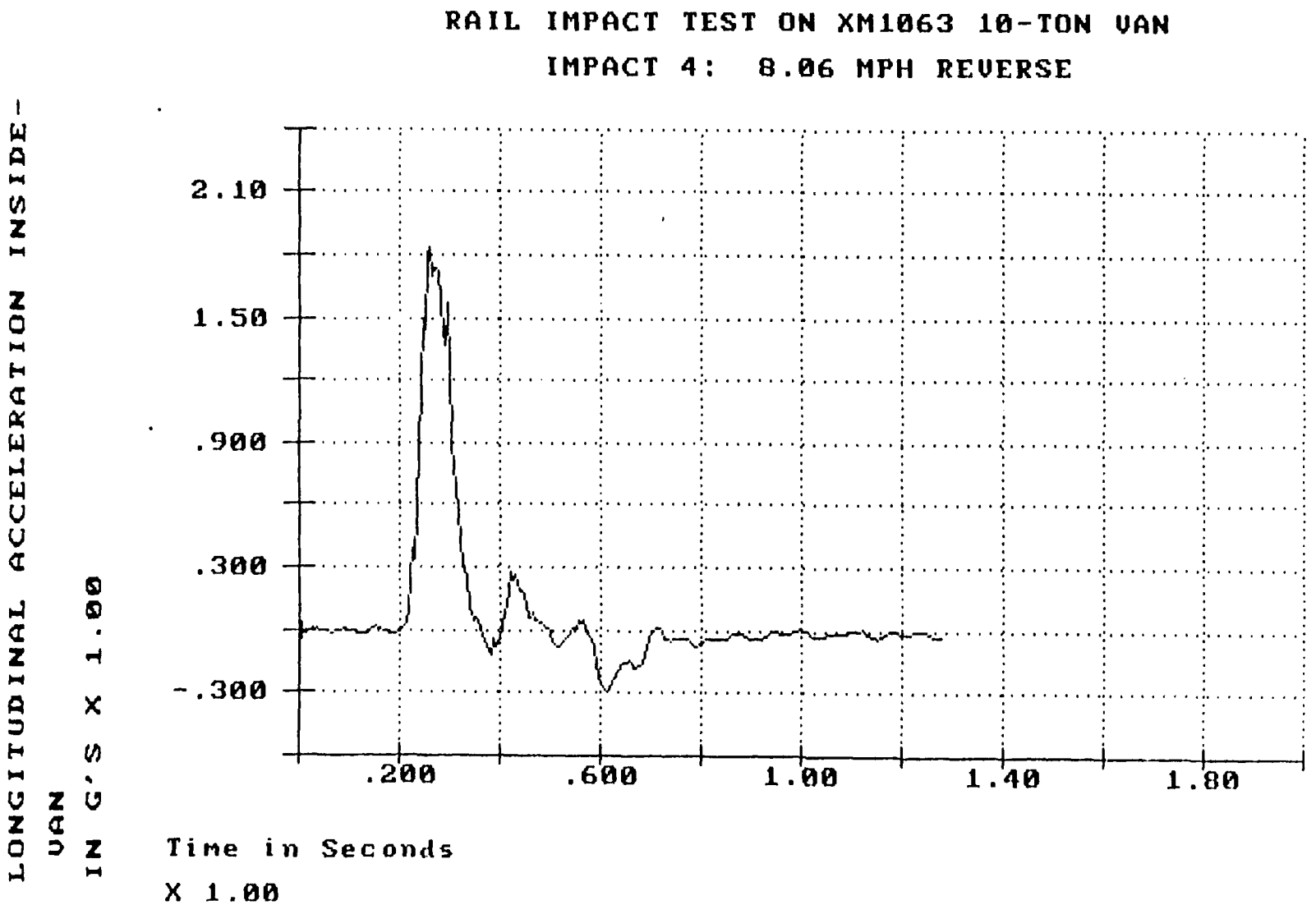


LATERAL ACCELERATION INSIDE VAN

IN G'S X 1.00

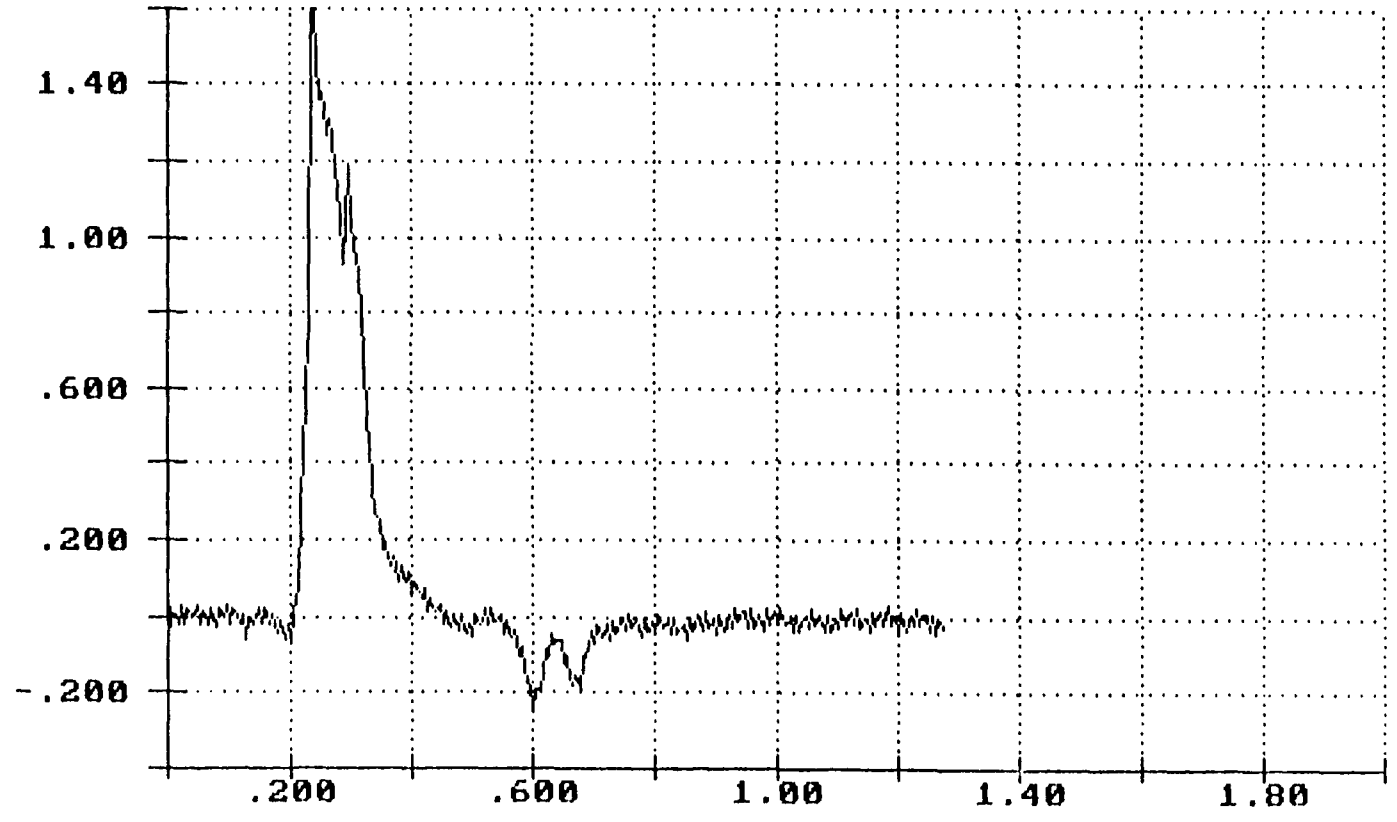
Time in Seconds

X 1.00


RAIL IMPACT TEST ON XM1063 10-TON VAN
IMPACT 4: 8.06 MPH REVERSE
LONGITUDINAL ACCELERATION INSIDE-VAN
IN G'S X 1.00
2.10
1.50
.900
.300
-.300
.200
.600
1.00
1.40
1.80
Time in Seconds
X 1.00

RAIL IMPACT TEST ON XM1063 10-TON VAN

IMPACT 4: 8.06 MPH REVERSE

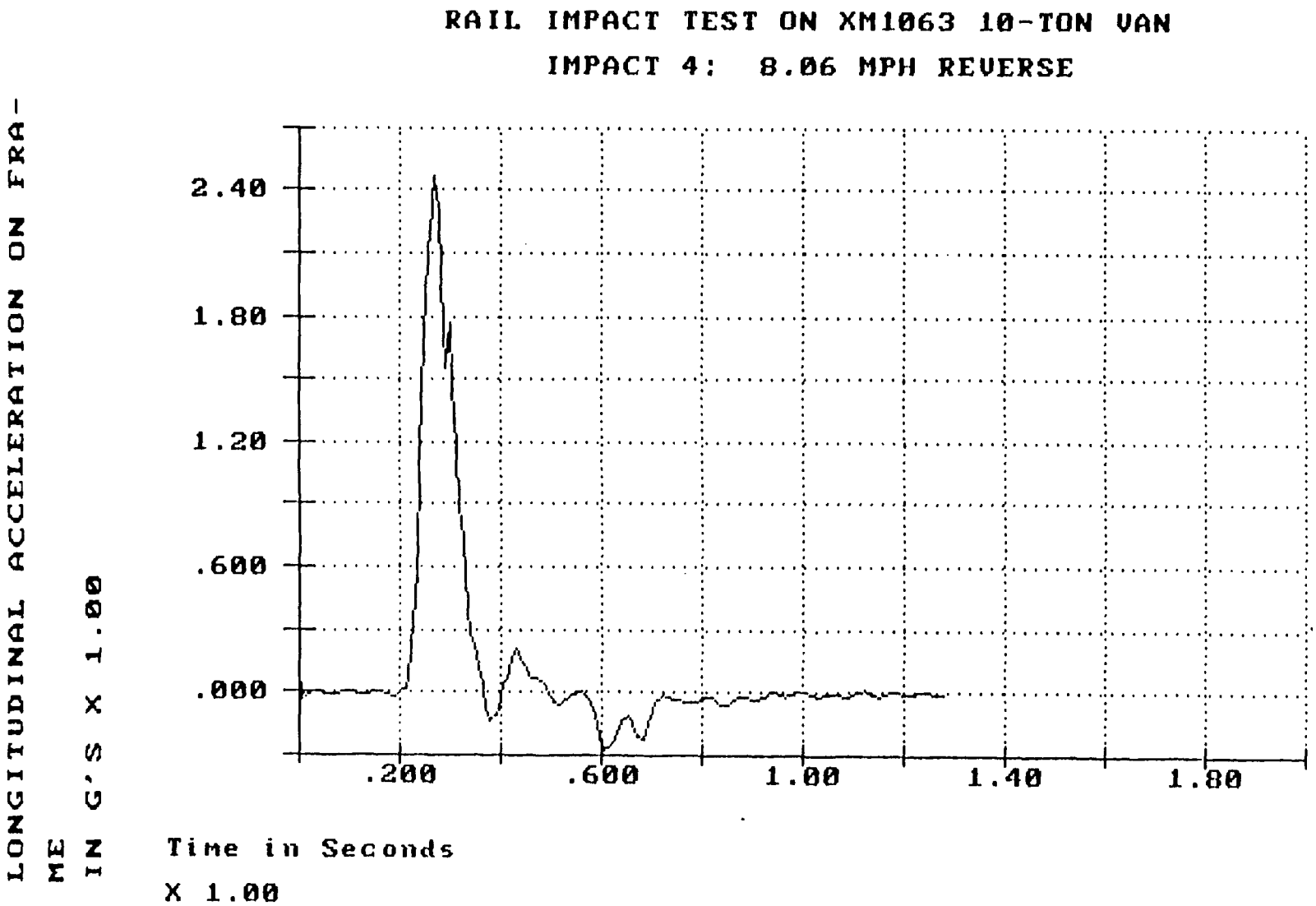


RAIL COUPLER FORCE

IN POUNDS X 100000.00

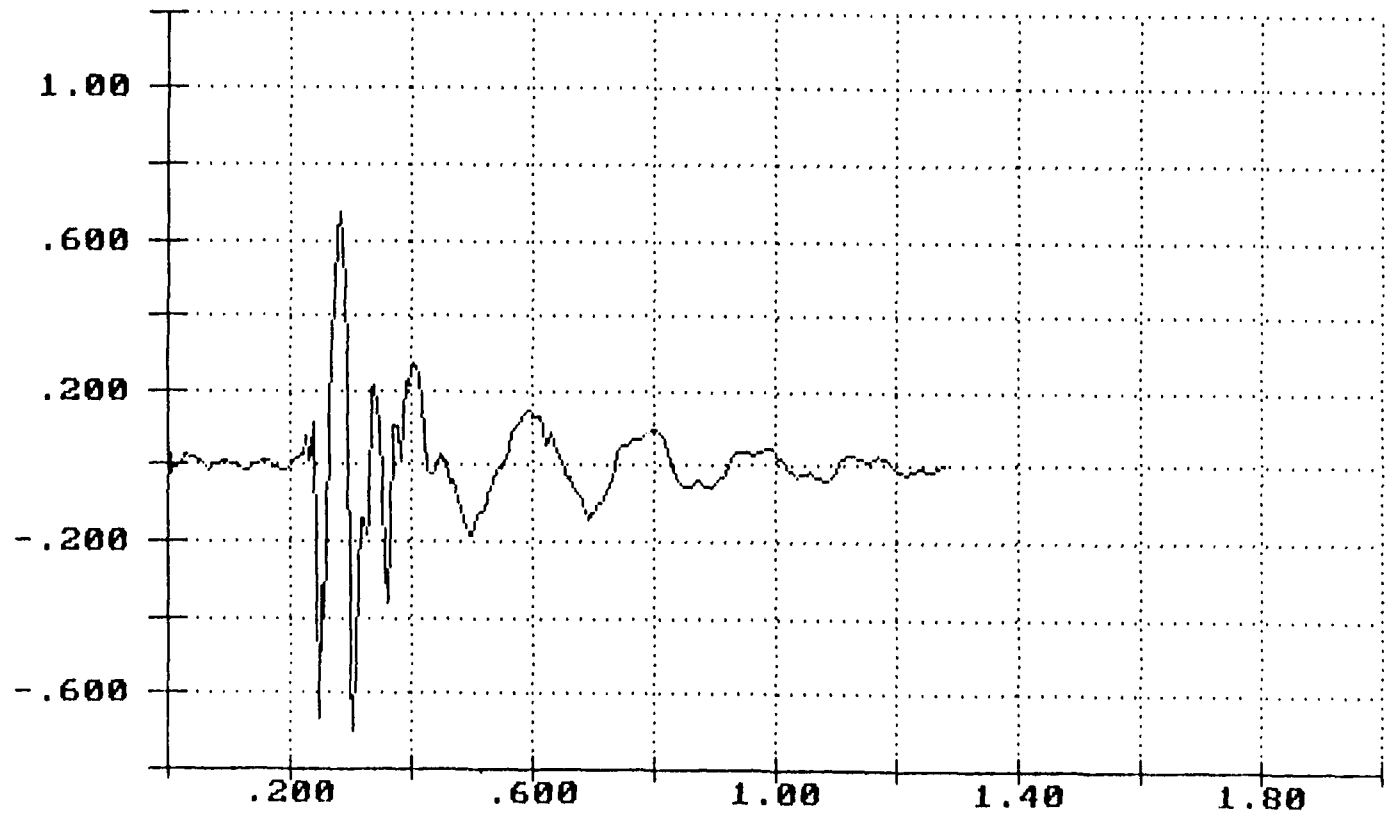
Time in Seconds

X 1.00


RAIL IMPACT TEST ON XM1063 10-TON VAN
IMPACT 4: 8.06 MPH REVERSE
LONGITUDINAL ACCELERATION ON FRAME IN G'S X 1.00
2.40
1.80
1.20
.600
.000
.200
.600
1.00
1.40
1.80
Time in Seconds
X 1.00

RAIL IMPACT TEST ON XM1063 10-TON VAN

IMPACT 4: 8.06 MPH REVERSE



VERTICAL ACCELERATION ON DOLLY F-
RONT
IN G'S X 1.00

Time in Seconds
X 1.00